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THE MAKING OF  
AN EXECUTIVE

# THE MAKING OF AN EXECUTIVE

BY  
A. HAMILTON CHURCH  
INDUSTRIAL ECONOMIST



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## FOREWORD

In this book the author first tries to develop in the reader the executive viewpoint; he then describes the personal qualifications and special knowledge required by the executive. He covers clearly and concisely and in logical sequence the various departments of a business organization, showing their relationship one to the other and to the business as a whole. The fundamental principles of lay-out and organization of a business as a whole and of the separate departments of a business are discussed in detail, as, also, are the principles of office and factory routine and methods of control by means of analytic reports and graphic charts. Mention also is made of the tools of management in the way of mechanical aids that are available and in use in all efficiently operated organizations.

The aim of the book is to give the reader in condensed form a connected idea of the fundamentals of business organization and routine, which knowledge every executive must possess. The author has not confined himself merely to routine and lay-out, but gives many valuable ideas in connection with employment and welfare work, the human element in business, and means of reducing labor turnover, the personnel-relations side of management being interwoven throughout the entire book.

A due amount of attention is given to the interpretation of financial reports as well as to the control of expenditure and the management of finances. Problems of reconstruction, betterment, and planning are also discussed at length. No matter what position the reader may occupy in the business world, he will undoubtedly find much information of interest and value which will be an aid to him in forming ideas for constructive work in his own business.

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# THE MAKING OF AN EXECUTIVE

## CHAPTER I

### REQUIREMENTS OF THE EXECUTIVE

#### INTRODUCTION

1. **New Demands of Modern Conditions.**—A material change has, in recent years, taken place in the character and extent of the qualifications demanded of the high-class business executive. There was a time, not so long ago, when perhaps no very exacting requirements were made of him as to special knowledge or training for his task. The men who rose to executive positions did so, in the majority of cases, by a natural process of survival of the fittest. They were men who had succeeded above the average in "picking up" such details of business as they met with in the ordinary course of their duties. Today the case is far different. The tendency is to raise the qualifications required for important executive positions, until it has come about that business administration has practically developed into a definite profession. In this Section of the present study there will first be presented a brief outline of (a) the viewpoint and (b) the personal qualifications of the executive, as dictated by modern conditions; they will follow a bird's-eye view of the various branches of (c) special knowledge, commercial, economic, etc., with which the man aspiring to an executive position needs to become familiar.

## THE EXECUTIVE VIEWPOINT

**2. Executive and Subordinate.**—One important difference between the executive and the subordinate lies in their points of view. To a large extent the work of the subordinate is defined and detailed for him. He has comparatively little option and a strictly limited responsibility. A faithful performance of routine duty is the main thing, perhaps all, that is expected of him. If he is bright and ambitious he may find opportunities to suggest improvements; but the responsibility for accepting or rejecting these suggestions does not rest with him. His outlook is confined to the means of realizing personal efficiency in a few comparatively simple duties. The work of the executive, on the other hand, is almost precisely the opposite of all this. His work is of a general nature, and how far it is detailed, planned, and reduced to a reasonable routine depends very largely on himself. So far from having only a limited option, he not only may, but he must, make independent decisions; opportunity is always knocking at his door. His responsibility is great, since it embraces not only his own personal relation to his work but also that of his staff. Still more is he responsible for results, that is, for the degree of efficiency reached in the operations over which he has control; and as a usual thing this efficiency is measured by financial standards—he must make things pay.

**3. Executive Training.**—The objective of special study and training for executive positions is the systematic acquisition of the knowledge that has been found necessary to those who have held such positions in the past. It is not, of course, possible to teach executive ability, since the aspirant must bring moral and physical qualifications of his own to the task, beyond the power of others to provide if he does not possess them. But it is quite possible, and indeed easy, to provide the means of building and developing such ability, because this is largely dependent on the acquisition of (a) somewhat varied and extensive special knowledge, and (b) of the special executive viewpoint necessary to coordinate and make available the

special knowledge so acquired, or in other words to apply this knowledge. It is therefore more than a set of isolated facts or the manipulation of a number of fixed methods that the executive has to assimilate. It is rather the scientific spirit of modern business that he must learn to understand and to appreciate. Between the old type of executive and the new there is not only a difference of knowledge, but still more one of outlook. The modern executive has much more need of an open mind, ready swiftly to adapt itself to change, than had the executive of twenty or thirty years ago.

**4. Survival of Old Methods.**—It may be asked why any attention should be paid to the standards of the past, or why such stress should be laid on the difference in outlook and spirit between the old-time executive and the new. The answer is that these old standards still linger. Not all the 275,000 establishments enumerated as manufacturing enterprises by the census department are on the high level of the best type of modern business. There is still plenty of opportunity to acquire the old outlook and the old methods. Many thousands of businesses are falling behind in the race and their executives are unable to understand why. It does not follow that such concerns make no attempt to go with the times. In many cases they do. They adopt a device here, a method there. They try out this or that suggestion which they pick up in the pages of a magazine. Sometimes these new ideas work well, sometimes they do not. It hardly matters which, for success can only come as the result of the whole business organization, from the executive downwards, becoming permeated with the modern business spirit. It is this, just as much as the practical methods and devices that modern business makes use of, that is the secret of its superiority to the old order of things.

**5. The Modern Spirit.**—It is not, of course, possible to describe in so many words in what the modern business spirit consists. It is not a matter that can be either stated or learned. It must be absorbed gradually from a study of modern methods and inferred from the principles that serve



to guide these methods. Industry is not peculiar in this. The spirit that animates the medical profession, for example, is nowhere a textbook matter. It can neither be taught nor learned—it can only be assimilated. When a man has completed his medical education, he has either assimilated the spirit of the profession or he has not. It is the same with modern business. The development of the right spirit will depend on a broadening of the understanding as the result of contact with the ideas and methods that have become standardized in the profession. There is no short cut to the acquisition of this point of view. At the same time it may be possible to point out certain features in which there is a sharp contrast between the old and the new ways of regarding business operations. This will help to throw the modern spirit into relief and make its character plain. Three or four of these salient features will therefore now be discussed.

**6. Scientific Method.**—One of the most noticeable things about the progress made in recent years is the introduction of the scientific viewpoint into business. What is the scientific viewpoint? This, again is difficult to put into words, but it may be gathered from an illustration. Suppose that some unexpected difficulty arises. For example, a product, which in the past has been manufactured regularly and successfully, suddenly develops some unaccountable imperfection. What is to be done? There are two ways of handling the situation. One is to attempt a solution of the difficulty by a series of arbitrary experiments, conducted at haphazard, in the hope of lighting, somehow, on the right procedure. The other way, sometimes the slower, but always the surer, is to sit down and analyze the process into its elements, follow step by step the stages by which the original satisfactory result was reached, consider in each case the exact influence of the material employed, and so come to an understanding, not only of the cause of the present failure, but also of the *conditions of success*. In general the scientific method depends on taking nothing for granted, and becoming familiar not only with broad or practical results, but also with the infinitely small influences

and conditions that go to build up results of all kinds, both successful and unsuccessful. In other words, it is mastery of minute details and of fundamental principles that is aimed at.

**7. Clear Perspective.**—An important habit for the executive to acquire is that of regarding his business in due perspective. He must, as it were, get away from it and far off, and endeavor to regard it from a detached viewpoint. In order to be able to do this, evidently he must not himself become so immersed in detail that all sense of perspective is lost. One of the important arts of modern business—and one to the development of which many methods and devices will be found in the following pages—is the ability to generalize facts and figures so that their general trend is made visible, without the necessity of going through a mass of detail before they can be grasped or understood. The skilled executive should stand apart from the rest of his organization as an observer. His own part in the business should be that of making decisions based on the interpretation of important groups of results as presented to him periodically and punctually. He may, of course, double this part with that of active participation in the handling of some detail of which he feels himself to be master; but the larger the business, the more important it is for the executive to refrain from personal contact with routine, and to keep his mind fresh and elastic so as to carry out his true function effectively.

**8. Delegation of Duties.**—It follows from what was said in the last article that much of the executive's success will depend on the way in which he delegates duties to others. In the growth of a business from very small beginnings, the man who was originally proprietor, worker, salesman, treasurer, and everything else, gradually sheds one function after another, until in the large business he remains without any routine duties at all and his work is confined to pure decision. In technical language, only the determinative function remains to him. A good deal will therefore be said in the course of this work about the layout, that is, the mapping or planning of

duties. It will be seen that it is possible to allot the spheres of duty with considerable precision; and, in fact, the larger the business, the more important does this become. The great captains of industry have notoriously succeeded not merely by a gluttonous capacity for work, but by shrewd sizing up of other men and putting them in positions for which they were fitted. Henry Ford, for example, is reported as having humorously remarked that in his plant he was the only man with nothing to do. The idea is a correct one. It would appear that he has reserved for himself the only true executive function, that of decision. But this in turn implies a very carefully prepared and laid out system of organization.

**9. Use and Abuse of System.**—System, by which is meant settled methods of doing routine work, is by no means a modern development. Whenever routine exists there must be system alongside it, because system is merely the defined habit of doing things that have to be done over and over again. The man with the most morbid hatred of system nevertheless follows it unconsciously. He must have certain settled ways of doing routine work, or it would never be done twice alike. The great difference between the old and the new business in respect to system is due to the much greater complexity and exactitude of modern business operation, which necessitate correspondingly increased attention to systematic procedure. At the same time it is well to remember that there is such a thing as too much system, or too much red tape, to use an expressive popular phrase. The overdevelopment of system arises from an imperfect appreciation of the due place and use of system. Where the whole field of routine is mapped out in advance, and system gradually established in such a way as just to effect the necessary coordination and no more, the choking influence of red tape will be avoided. No item of system should ever be installed without previous careful consideration of its influence on other parts of the system, and only so much as is sufficient and is found to expedite work should be allowed. Systems should not be developed by over-enthusiastic, unqualified, and inexperienced persons.

**10. The Importance of Savings.**—One of the circumstances that have been brought into the limelight by the application of scientific methods to business is the multiplied importance of small savings in operations that are repeated many times over. Ten dollars wasted, or not saved, every day, in a plant, means an annual loss of over three thousand dollars, or *the interest on \$50,000 at 6 per cent.* The great importance of little things needs no further demonstration. Now, this wastage may take many forms. It may be in material, or in operative processes, or in power consumption, or in over-developed system, or in idle machinery. Again, it may take the form of failure to utilize commercial wastes and by-products by marketing them or converting them into useful product. All these are obvious sources of waste. But the loss may also come from a wholly different direction. It may arise from insufficient system, or from an under-development of system. It may be caused by delays, errors, and misunderstandings, due to failure to convey instructions in written, definite form; or there may be want of coordination in the different stages of manufacture, causing dearth of parts in one place and superfluity in another; in short, losses may arise from purely executive shortcomings. One duty, therefore, of the modern executive is to avoid, by the adoption of exact methods and good organization, all conditions that lead to even small wastes, especially if these are of the kind that are repeated day by day.

**11. Keeping Abreast of Progress.**—The old-time executive did not have to worry himself much about progress. The development of business was slow and gradual; consequently, the danger of competition was not very great. The modern methods of creating commercial business by mammoth drives had not been invented. If it took years to build up a large undertaking, it also took years for it to decay under the assaults of competitors or from failure to keep up with technical progress. But today all this is changed. The introduction of scientific investigation into trade processes has caused great disturbance in many industries and has driven



many an unprogressive producer to the wall. In these days the executive must exercise unrelenting vigilance to insure that his competitors are not getting or preparing to get a strangle hold on his outlets for product; at the same time he must be constantly on the watch to observe new ideas, new machinery, and new methods that are being developed in the trade and its associated professions. Unpreparedness, in business as in war, is always a very costly and frequently a fatal error. Keeping watch on the commercial and technical situation is particularly a function of the executive, and this is another reason why he should not overburden himself with unnecessary routine work.

#### PERSONAL QUALIFICATIONS

**12. Body, Mind, and Will.**—A detailed discussion of the moral and physical qualifications necessary to the executive would be entirely beyond the scope of this discussion. A very brief review of some of the requisite qualities must here suffice. Some of these are inborn; others can be strengthened and perhaps developed, when absent, by suitable training and effort.

A sound, responsive mind in a sound and healthy body are usually considered to be among the prime elements of success. Physical training—keeping fit—can do much for the body, while the mind can at least be kept from deteriorating—it can be preserved from either rusting out or wearing out. But, after all, very little is known about such matters. Some great men of affairs have contended against wretched physical health and have triumphed in spite of this handicap. Perhaps the most important qualification is the possession of a strong will. This does not mean a violent temper, although the two things are often confounded. It implies a high degree of self-control, and though this is for the most part a natural gift, there seems to be no doubt that self-training can develop it to a satisfactory degree. A person who uses his will to control and direct his mental processes has an enormous advantage over one who is, like a weather vane, immediately respon-

sive to exterior impulse. But practical psychology has not yet advanced to the point where it can be trusted as a guide to self-development.

**13. Precision.**—Certain qualities are undoubtedly indispensable for the modern executive. Among the most important of these is a precise habit of mind. Again, this must be regarded as a natural gift. Mental untidiness and inexactness are as natural to some people as precision and accuracy are to others. But without doubt the defects named can be, at least to some extent, corrected, even though the process be a slow and painful one. For the executive, however, it is essential that he should possess or acquire the habit of being right, rather than nearly right. Precision, with which is closely connected the equally important quality of punctuality, can be increased by suitable training. The habit, for example, of putting things off is a fatal one, but it can nearly always be conquered. Similarly, exactitude of statement and thought can be cultivated. It is, with practice, as easy to be correct as nearly correct. Vagueness of all kinds is one of the great business pitfalls. If a man finds, after sincere and prolonged effort, that he cannot get into the habit of thinking and acting with precision and punctuality, he may be sure that however suitable to other walks in life, he will not be a striking success as an executive.

**14. Courtesy, Dignity, and Firmness.**—The executive should never forget that he is set and lives on a pedestal. Any man to whom fate has assigned the leading of other men will usually be regarded by them in one of two ways—he will be either disliked or admired; indeed, so strangely compounded is human nature, that he may both be disliked and admired at the same time. The essential thing, then, is so to act that admiration is conceded, however grudgingly. To discuss the fine points of personal conduct is too large a subject. It may, however, be pointed out that the three qualities set at the head of this paragraph are not by any means mutually exclusive. Firmness is an absolutely essential qualification to any executive, but it is quite compatible with courteous treatment. The

old saying, "The iron hand in the velvet glove," is perhaps not very far from the right motto for the executive. Firmness and harshness are closely connected, but training can effect their separation. Stern and harsh expression is necessary under certain circumstances, but in ordinary cases extreme firmness may be coupled with an even courtesy of demeanor, provided that a strong effort is made to connect the two at all times. The case of personal dignity is somewhat similar. It should be an essential part of the executive's equipment, tempered with courtesy on all occasions. The executive's bearing should not, of course, be stiff and wooden, but should be sufficiently reserved to keep undue familiarity at a distance, while responding without coldness to situations where repression is not required.

**15. Worry.**—There is a popular saying that "Care killed the cat." Care has also filled the cemeteries to a much greater degree than work. The attitude of the executive toward his work and his responsibilities will determine his success in no ordinary measure. Many executives fall into the very bad habit of being completely mastered by their business—eating with it, taking it home with them, going to bed with it, and dreaming of it. No one can stand up long under such a habit. If it has been acquired, nothing is more important than to subdue it, and at once. The practice should be established of dismissing all remembrance of work as the business threshold is passed. Let the brain cells that have been engaged on business problems have a chance to rest. A fatigued mind is a useless mind. If all business thoughts are dismissed as a regular practice after the business day is over, the mind comes to their study next morning with renewed freshness and vigor.

**16. Meeting Abnormal Strain.**—The foregoing counsel is, of course, to be applied with common sense. There are always likely to be periods in business when a man is working against time, and must keep on the job until his mind reels. But this is a different matter, not a good thing, but an unavoidable one. What is important is the usual, regular prac-

tice—the habit. The man who habitually gives his brain cells rest at the proper times is far better equipped to meet a sudden and urgent strain on his faculties than one who has fallen into the bad habit of constant worry.

**17. Judgment By Results.**—The young executive especially, is likely to fall into the habit of unremitting absorption and worry in his work. He is liable to suppose that a reputation for always poring over his work is going to recommend him to his superiors. In the long run this will not be so. He will be judged by what he has accomplished, not by his personal manner of accomplishing it. And it is quite certain that he will do better justice to himself by refraining from abusing his mental mechanism.

**18. Worry, Not Work, Saps Energy.**—It must not be understood, however, that the throwing off of business worries as a regular practice implies a necessary idleness during the remainder of the day. If this were so, it would bar the way to further study and progress. It is necessary to understand the difference between work and worry. The thing to be avoided is the constant goading of the same set of brain cells. A healthy and vigorous young man is quite capable of putting in a full day at the office or in the plant and then turning to the study of some special subject, provided that his mind is clear and unburdened. A fresh set of cells will be brought into play, while the others rest. This can be realized only if he cultivates the habit of automatically dismissing the occurrences and worries of the day *entirely* from his mind.

#### SPECIAL KNOWLEDGE REQUIRED BY THE EXECUTIVE

**19. Introductory Remarks.**—In addition to acquiring the executive viewpoint and bringing to the task the proper personal qualifications, the modern executive has necessarily to become acquainted with a number of varying techniques. Purchasing, manufacturing, employing, and selling, each involve a whole series of special problems, and the exact bear-

ing of each of these on the welfare of the business as a whole must be grasped and understood. Beyond these matters there lies a field peculiarly that of the executive himself, namely, the financial management of the enterprise. In this department the experience acquired in other activities will at best give but little aid. Financing is a subject demanding the closest attention and the clearest understanding. Its problems stand by themselves, and yet are inextricably interwoven with the doings of manufacturing and selling. Bad financing may undo the good work of the productive departments and bring the business to a standstill. Of course, a similar remark might be made with regard to any individual department. Inefficiency at any one point of a business enterprise will more or less offset the good work of other departments. But financing is more potent for good and evil than any of the other departments, since, in a sense, it is the regulator of them all.

**20. Mechanical and Other Aids.**—It is well known that if anything can be made visible to the eye, that is, pictured, it will be more readily understood and absorbed than if merely described in words or told by figures. One of the important departures in modern business is in the direction of making use of this mental peculiarity, possessed by nearly every one, and applying it to picturing business conditions. Graphic representation, as it is termed, is in the main a method of replacing numbers by lines, but it is also much more than this. It enables relations between two quantities to be brought out and understood with a readiness and clarity that can be attained by no other means. The use of graphs and charts, in which numbers are replaced by lines or curves, is one of the first of the new ideas that must be assimilated by aspirants to executive positions. Graphic representation may be described as a kind of executive shorthand.

**21. Analysis of Operations.**—The next matter to be taken up is that of the modern employment of analytical procedure in the solving of business problems. The main idea involved is the resolution of each problem into its components.

But in addition to this the element of exact measurement is always introduced. This measurement is applied to the ultimate result of the analysis, to the last and finest subdivision arrived at in splitting up the problem into its elements.

**22. Motion Studies.**—As an example, to illustrate the point of the last article, an investigation might be made of the problem of a man carrying a load upstairs. In this case not merely the total time taken in making the ascent would be measured, but the actual brief time occupied by the act of stepping itself. This would be a *time study*. Then, if it seemed desirable, the investigation would proceed beyond even this detail, and investigate the separate motions made by the foot, again timing and measuring each motion. As a result we should obtain a very thorough understanding of all the elements involved in the act of ascending stairs with a load, which might or might not lead to improvement, in the height and shape of the steps, in the amount of load carried, etc. The general principle involved is to take nothing for granted. If investigation is made, let it be ultimate and final investigation. Guesswork and mere judgment or opinion are discarded in favor of measurement and exactitude. Then, whenever progress is made, it is solid progress.

**23. Layout and Routine.**—Analysis is also applied in a quite different field. Anything that contains elements or steps can be analyzed into such elements, and their bearing on the whole measured. Now it will at once suggest itself that a plant in full work must be made up of a very large number of separate parts, or apparatus, engaged in as many different activities, all of which are of course capable of analysis. This is actually the case. Manufacturing operations take place in set stages, and between these stages there is a continual movement to and fro of material and product. The actual arrangement of the machinery is called its layout, and the path traced by the material is called the *routing* of the material. Office desks and the papers that pass between them also can be considered from the viewpoint of a layout and a routing. Further, the organization itself can be regarded in the same manner.

Layout of an organization implies determining the exact duty to be performed by each person or function, and tracing the relations each has to every other. In all these cases the same analytical procedure is applied. The operations involved are first carefully analyzed into their ultimate stages or steps, and the routing between the steps is then investigated to see that it everywhere follows the shortest path and bears the simplest possible relation to the stages between which movement takes place. (Layout and routing analysis is one of the most important aids in every business activity.)

**24. Visual Control.**—Another device of considerable importance, and one which has not yet reached its ultimate development, is that of ~~visual control~~. This takes many forms, all having this fundamental feature, that the progress of events is charted upon a sheet or board. Such a chart may not only visualize past events, but may be used also to note down the intended future course, just as a calendar may be used to jot down memoranda of things to be done on specified future dates. In this way the proposed movements of orders, or of material, and other business transactions, can be set down in a way that immediately appeals to the eye. Complex activities, that might otherwise be concealed in records spreading through many sheets of paper, are so pictured that observation of them is made easy, and as a consequence a high degree of control over such activities is secured.

**25. Meters and Recorders.**—Finally, there is the use and value of a wide assortment of mechanical appliances to be understood. Modern business being increasingly based on measurement, many of these devices are concerned with measuring, recording, metering, and registering various forms of energy used in the plant, or the quantity and intensity of various factors entering into manufacturing operations. Prominent among these are appliances concerned with the measuring and recording of time.

**26. Calculating and Statistical Machines.**—Another class of mechanical aids have to do with calculations and

statistics. Some of these simply do what the brain does, only without fatigue and with perfect mechanical accuracy; but others are employed for doing things that combine various mental activities and therefore perform work that cannot be directly done in any other way. Some calculating machines, which not only perform complex calculations but also offer proof that the basis of the calculation is that of the written figures, are marvels of mechanical ingenuity. So also are bookkeeping and billing machines, some of which add, multiply, divide, calculate percentages and discounts, and typewrite at the same time. Finally there are statistical or tabulating machines that sort, analyze, group, and classify statistical data to any desired degree of refinement by simple automatic processes. Other devices include mechanisms for communication, of both word and document, duplicating, copying and addressing devices of many kinds, and the considerable class of indexing appliances on which efficiency in office management largely depends.

The larger part of these appliances and aids are of very recent development. More and more, business is making use of these methods and devices, and in studying modern ways of doing business a knowledge of all of them is quite necessary. Just as an artist must first learn the use of his brushes and his colors before he can begin to paint, so the would-be executive must understand the range and application of these new instruments if he would find the key to success.

### THE OFFICE

**27. Office Activities.**—While the term office is somewhat elastic, and applies to any place in which the work is done with paper, pen, and ink, technically speaking the office is that place wherein certain relations with the outside public are centered, through such agencies as correspondence, billing, credits and collections, and the receipt and handling of orders. The office is one of the two great links between the executive and the business world, the other being the selling organization.



**28. Contact With the Public.**—In a very direct sense the office is the aspect of the business which is turned toward the public. It speaks for the executive and the firm, and has several distinct contacts with prospective and actual customers. The proper regulation of these contacts is most essential, since by the attitude observable at these points of contact the policy of the firm will be judged. An important executive duty will therefore be the organization of relations with the public.

**29. Office Organization.**—The general subject of office organization comprises layout, first of the divisions, sections, and bureaus among which the work is divided, and next, layout of the routine that coordinates these divisions. As the work of the office in dealing with orders is one of its most important functions, the layout and routine of orders should be most carefully planned, because it forms, as it were, the pivot round which the whole office activity turns, orders being the life blood of business.

**30. Physical Layout.**—When the organization and routine have been determined, the next step is to consider the physical layout of divisions and rooms. This should follow and not precede the planning of duties, because the proper space and the proper fittings and furnishings can be estimated and planned only after the operations themselves are clearly laid out.

**31. Executive Control.**—The foregoing matters are concerned with the building up of an adequate office organization. When the office is in active operation, methods must be set up by which the executive can control its operations without becoming deeply immersed in the detail of its routine. The tone of correspondence must be controlled; the time-progress of orders, that is, the presence or absence of delays, must be noted at frequent intervals; the degree to which all sections are keeping their work up to date must be watched; and finally, the control of office expense has to be made thorough and effective. These are some of the main matters with which the executive must become familiar in connection with the work of the office.

## MATERIAL

**32. Introductory.**—All manufacturing operations begin with the acquisition of material on which the operations are to be performed. An adequate and uninterrupted supply of material is one of the essentials of success in manufacturing, and a thorough command of all the steps involved in maintaining this supply is absolutely indispensable for the executive in charge. The practical stages in the process of acquiring materials are: Specification, requisition, purchase, inspection, storage, and issue.

**33. Specification.**—The precise character of the material required must be determined, if necessary by special investigation, laboratory experiment, or other suitable measures. In the case of certain staple materials, such determination may be made once for all. In other cases a separate investigation may be necessary on repeated occasions. The precise character of the goods required having been decided upon, these requirements are set down in a written statement, the *specification*, in suitable terms.

**34. Requisition.**—The specification can then serve as the basis for the *requisition*, a written statement showing what quantities of such material are required for immediate use, and the minimum that should be ordered.

**35. Purchasing.**—Next in order, after specification and requisition have been made out in due form, comes the actual purchasing of the material. Here one of the problems to be met is the setting up of an adequate organization, comprising a layout and a routing. Provision must be made for seeking and recording bids, for indexing records relating to prices and market conditions, and for observing very closely the way in which deliveries are made and promises of delivery are being kept. Visual control is made use of in this work.

**36. Inspection, Storage, and Issue.**—Incoming goods are inspected to see that they agree in quality and quantity with the requirements of the specification and requisition. The

manner of storing is so designed that any material desired can be instantly identified and located when required. Certain formalities must be gone through in issuing material from stock, to register the transaction and at the same time to maintain a record of the stock on hand, as a guide in making future requisitions. Here again layout and routing are involved. Adequate system for locating and indexing must be established, proper accounts set up, and quick methods of counting and weighing installed. In addition to the layout of organization, the physical layout of the storeroom is a matter of great importance, inasmuch as it is intimately connected with the location and indexing of material.

**37. Handling Material.**—Considering the vast amount of movement that is constantly taking place in a plant, the importance of moving material with the minimum of rehandling will easily be appreciated. Labor-saving devices must therefore be studied and installed where their use promises to reduce expense or expedite operative work.

**38. Executive Control.**—Finally, when a satisfactory purchasing and storekeeping organization has been set up and fully equipped, there remains the question of executive control. As the purchasing department is essentially the great spending department of a business enterprise, executive control must be directed not only to observation of the current working, but also to the degree to which capital is being locked up in the investment in material. Again, the amount of future liability being incurred by the purchasing department is a matter requiring the close attention of the executive, and in both of these cases graphic representation is made use of to signal to the executive whenever it has become necessary for him to investigate personally what is going on.

## THE FACTORY

**39. Classification of Activities.**—The operations of a modern factory or plant constitute in many cases one of the most complex organizations to be found anywhere. At first sight the multitude of different activities, processes, and services that are observed in simultaneous operation seem to offer no hope of systematic classification. In practice, however, it has been found possible to reduce all varieties of plant activity to a few main groups, according to the functions which they perform. A grasp of this classification paves the way to the possibility of setting up an organization for plant affairs, that, despite its complexity, can be established with precision and success.

**40. Functions in the Factory.**—Each main group of activities revealed by analysis has a specific aim, a specific function to perform. Of such functions there are five, namely, *design, equipment, control, comparison*, and the actual manufacturing process itself, which is termed *operation*. Each of these functions has its own separate organization and its own separate efficiency. Some of these functions have much greater development in some plants than in others. The function of design is, for example, very important and highly organized in an engineering plant, and hardly distinguishable in an ink factory or a soap plant.

**41. Design** is that function which plans the product. It will accordingly vary in importance as the product is complex or simple. The result of design may be a set of drawings worth thousands of dollars or it may be a chemical formula that can be written on the back of an envelope. But, as faulty design vitiates all subsequent operations, and cannot be rectified by the highest efficiency in the other functions, the necessity of thoroughly grasping its true relation to the rest of the organization in any given plant will be manifest.

**42. Equipment** is the function that provides the necessary conditions, material and otherwise, for carrying on

operations. It furnishes not only the buildings, machinery, and so forth, but concerns itself with the layout of machines and accessories in shops and departments, and with the assignment of the proper relative location of the several departments. It furnishes adequate handling and transporting machinery and methods. Under the heading of equipment falls also the provision of services, such as power service. A proper organization of the equipment function is antecedent to everything except design. The routing of material and product will entirely depend for its efficiency on the skill with which layout of equipment has been effected.

**43.** The next function is that of **control**. The layout and distribution of staff duties and the whole mechanism dealing with orders are comprised in control. Much use is made of visual control as regards planning the course of manufacture, observing the progress of orders, and ascertaining the degree to which the operative machines are being loaded, as compared with their total and ultimate capacity. The control function is primarily concerned with keeping the plant at work.

**44. Comparison** is the function that records, compares, and reports. It records, in the first place, all matters of time and cost; that is, it includes cost accounting in all its developments. It is concerned also with inspecting and passing on product at the various stages of the manufacture, thus vouching for the amount of perfect product that is being obtained for the given expenditure. By an analysis of the factors of production the expenses of the factory are grouped in significant totals, so that one period can be contrasted with another. It also keeps close record of the actual working time of operative machinery, thus distinguishing between utilized capacity and wasted capacity in the shops.

**45. Operation** is the actual productive function. It has to do only with the productive processes. The importance of isolating this function and considering it separately from the other activities of the plant will be found in the fact that it is the only function that makes money. To keep operation going is the end for which all the other functions are organized, but

however extensive these latter may be, their only excuse for existing is the assistance they give in their various ways to operation. Except as productive machines are actually doing work, money is not being earned. Obvious as this is when stated, in many plants it is not by any means given full practical consideration. Insufficient attention to the fraction of their full capacity to which operative machines are working is far too common, and may be said to be almost universal, except in plants that have adopted modern methods of organization.

**46. Special Reports.**—The foregoing are the more important matters that have to be considered in relation to the factory. In addition there are certain aspects of factory activity of peculiar interest to the executive, with which he keeps in touch by means of specially compiled reports.

#### MARKETING THE PRODUCT

**47. Sales Organization.**—When product has been manufactured it has to be marketed, or sold. Marketing is a very different kind of activity from those already considered, but in the main, the same principles of layout, routing, and graphic representation are applied in the organization of this branch of business. This organization will cover the following points: (a) Consideration of the product and its adaptability to the market; this study should include not only the actual product itself, but also the methods of packing, casing, labeling, and so forth, that facilitate handling at various stages. (b) Careful study of the field or area in which the product is to be offered. Modern methods of analyzing the capacity of the field to absorb the product are highly developed, and include classification of prospective customers, layout of sales area, routing of traveling men, location of branch offices or distribution points, etc. (c) Organization of a sales department. (d) Development of methods by which the executive is posted on the general trend of the marketing operations.

**48. Influencing the Purchaser.**—In any sales operation there is on the one hand the product, and on the other



hand the customer or prospective customer; the problem is to bring these together. The first step is obviously to bring influence to bear on the mental condition of the customer that will lead him, first to appreciate the good points of the product, and finally to put his signature to the order. Hence, careful consideration has to be given to methods of influence. These are usually divided into advertising, mail, and direct or personal influences. The selection of the proper method of influencing potential purchasers is one of the most important matters preceding actual selling operations. It should be based on an exhaustive analysis and study of the field, guided by previous experience in sales work on a similar or closely allied product.

**49. Systematizing Sales Arguments.**—The training of salesmen is another matter to which much attention has been given of late. Selling arguments found successful in one case are likely to be successful in similar cases; consequently, it is possible to assemble information about the way in which customers can be influenced, and by committing this information to writing, and imparting it to the sales force by distribution of circulars or by talks and lectures, the salesmen are armed with a variety of weapons with which to overcome the various kinds of defense that customers usually put up.

**50. Close Relation to Executive.**—As the marketing of product is the only means by which money enters the business, it is of prime importance that the executive should be in full touch with the degree of success met with by the selling department. Selling costs money, and one method of control is by ascertaining, from period to period, the actual cost per inquiry and per order. The volume of business done in each of many sales fields is also to be watched closely, while it is also important to know to what extent customers are being held. A customer once on the books should be a permanent asset to the business. Sales statistics are of varied character, and in a business of any size the use of the tabulating machine method for analyzing and grouping them should be adopted.

### THE HUMAN ELEMENT IN BUSINESS

**51. Employment, Welfare, and Labor.**—Manufacturing and marketing are the two great practical divisions of business activity, both based on the conversion of material from its original or raw condition into something that fills a commercial want. But material passes through these various stages by human aid. Not only is it worked on directly by operatives, but a vast number of subsidiary activities are set up all around the operative processes, which have as their aim assistance to actual operation and to actual selling also. A great variety of human faculties are therefore concerned in business operation, and consequently, the questions arising out of employment and the welfare of employes are many and important.

**52. Employment and Job Analysis.**—As wage earners are much in the majority, the larger part of such questions are concerned with methods of selecting, training, keeping, and encouraging these. Just as the selection of the proper material by specification is advisable, so, much attention has been given of late years toward the selection of employes by specification of one kind or another. The problem of such selection has two aspects. First a survey must be made of the work to be done, so as to decide just what qualifications are necessary in the worker for each job; then methods must be devised by which such qualifications can be recognized in the applicants who present themselves for employment.

**53. Reducing Labor Turnover.**—The object of analysis of the job and the man is to fit the worker to the job. But it has also another aim, the importance of which is only now being generally recognized. It is found that the constant going and coming of employes—or, as it is termed technically, the labor turnover—is very costly, when all is reckoned in. It is therefore, important, after a man is engaged, that he should be held and not allowed to drift away. By taking pains to fit each worker with a job for which he is naturally adapted, it is hoped that turnover may be reduced.

Other methods to the same end are also adopted. In many cases it is found that it pays to give the worker a short preliminary training before he is passed on to the actual performance of the duties for which he has been engaged. This has many obvious advantages, particularly for certain types of employment.

Again, permanence of employment and a good spirit among the workers can be promoted by establishing pleasant working conditions. Development of a good labor environment is therefore one of the subjects that must be carefully worked out in the modern business. These remarks apply not to the plant alone. With equal force they apply to employes of every grade, in both the shops and the offices.

**54. Profit Sharing and Self-Administration by Labor.**—Finally comes the important question, now being very widely discussed, of how far labor can be admitted to a position in which it bears some of the burden of administration. It is found that there are many matters of detail that can very well be dealt with by committees of employes to the best advantage of all concerned. No broad-minded executive with modern outlook will fail to make himself familiar with recent developments in this direction.

#### PROMOTION OF QUALITY AND QUANTITY OF PRODUCTION

**55. Stimulating Interest.**—Labor has not only to be employed, it has to be stimulated and encouraged to take an interest in the work, and in the economy of manufacture. Product, moreover, must attain a certain definite standard of quality, else it is either not marketable at all, or at best it can be sold only with diminished profit. This implies not only that the operative skill applied to material shall be of the kind best fitted to produce good results, but also that the technical processes themselves shall be conducted in the most efficient manner, and that the equipment and organization shall always be kept tuned up to full working pitch.

**56. Good Operative Habit.**—The formation of good operative habit is one of the first considerations. This will often be much aided by the results of special motion studies. The analyzing and study of the operative processes is, however, a matter of gradual development, and should not be attempted without very careful consideration and planning.

**57. Revision and Standardization.**—Next in order is the matter of keeping the organization tuned up. To this end periodical examination, and, if necessary, revision, of layout and routing is advisable. Equipment must be kept in balance. In a growing business all these matters are apt to get out of gear, because such growth is not uniform in all directions.

The product itself has also to be standardized. This is a technical matter rather than one of management, yet it is necessary that the executive should understand the precise bearing of standardization, both on the cost of production and on the selling field.

**58. Adjusting Reward to Performance.**—Aside from the necessity of promoting quality and quantity, there is the very important problem of bringing improved results and increased reward into correlation. In other words, it is desirable to base remuneration first on quality and then on quantity. Nearly all methods of payment by results—piecework, premium, bonus, etc.—have this tendency, and it is this that makes them so important. In most cases, the reward is given for the production of work that is 100 per cent. of standard. Remuneration is sometimes based, however, on a different plan. In what is termed group bonus, the reward is, first, for quantity of 100 per cent. standard product, then for reduced cost of shop production of this quality, with quantity undiminished or increased. In other words, the reward is based on the saving of other things than time. To a strictly limited extent a sort of profit sharing is set up by this method, but it is not applicable to all kinds of business; or rather, it is more applicable to some conditions than to others. Piecework, premium, etc. are on the contrary almost universally applicable.

**59. Reports to Executive.**—Finally, the executive has to be informed as to the degree in which all the matters discussed in the preceding paragraphs are being successfully handled by his staff. Reports and returns, mostly on the principle of graphic representation, are therefore set up and submitted to him at regular intervals.

### FINANCE

**60. Transformation of Values.**—The basis of finance is the transformation of values. The main process of business is the purchase of material and of labor, and the transformation of the two into salable and sold product. The starting point is cash. The end of the business process is the return of cash in the shape of the customer's payment for the product that he has purchased.

**61. Locked-Up Capital.**—But all the cash with which a business commences is not transformed into material and wages. A very large amount of it is sunk in buildings and equipment. Further, another considerable amount is always locked up in what is known as work in process, that is, in material that has been worked on but is not yet advanced to the salable stage.

**62. Circulation of Liquid Assets.**—The business process, then, is one in which transformations of value are constantly going on. As fast as cash flows into the bank from the customer it goes out again to purchase labor and other services, material, and equipment. It will readily be understood that this process of circulation is one that must be maintained at all hazards. This implies, however, that a certain proportion of the property of the firm must be maintained in a liquid, or quick, form. If cash is expended on items that are not again transformable into cash with sufficient rapidity, a time will come when an insufficient amount remains in hand for carrying on the series of transformations. The first division of finance to be studied, relates to the different forms

which property assumes, and the due proportion that one kind should bear to other kinds.

**63. Current Expenditures.**—Much expenditure never results in the acquisition of tangible property at all. There is a large range of activities that are merely auxiliary to production. The power service may be taken as an example. Power is consumed every day, and disappears. Services of all kinds are on the same footing. Now, all this considerable expenditure has to be very exactly controlled, and in some way or other it has to be connected with product, or, more correctly speaking, with operative cost. Operation is the only money-earning function. Consequently, all other expenses must in some way or another be borne by the profits of operation. The methods of connecting operating, or flat, cost with expense are matters of great importance to the modern executive.

**64. Budget System.**—The executive must have a clear understanding of the methods of summing up and focusing all the changes in the condition of the company's property. Control of the finances of a business is coming to be established more and more by what is known as the *budget system*, which in effect is a system of forecasting probable expenditures and returns. Actual results are reflected, not only in numerous special reports, but also in profit and loss accounts and balance sheets. The balance sheet is the final and official test of the failure or success of business operations in a given period.

### DEVELOPMENT WORK

**65. Betterment.**—In the foregoing pages the business process has been regarded from the viewpoint of daily routine. The modern executive, however, must not confine his attention to current events, but must continually be looking forward to future possibilities. While observing the current efficiency of his business, he must not neglect the question of betterment which is also closely associated with extension of plants and organizations.

Betterment may be considered under three heads: Technical betterment, betterment of manufacturing processes and conditions, and management betterment.

**66. Technical betterment** has to do with trade knowledge. Almost every business has a technical side as well as a management and commercial side. Engineering, mechanical, and chemical data must be systematically collected and indexed for the use of the technical and operative staffs. Progress in such matters is always going on. Patents are being taken out, papers are being read before technical societies, information is published in trade papers, all of which cannot be ignored, but should on the contrary be kept prominently before the attention of such persons as are concerned with technical processes. Such information should also be disseminated amongst the workers to encourage them to take an interest in their work and fit themselves for better positions.

Technical research is often highly necessary to the continued welfare of a business. No one should rely on others for technical improvement. It is therefore necessary to supplement an exhaustive knowledge of what others are doing, by experiment and research on one's own problems. New uses for product, by-product, and wastes are thus frequently discovered and made available.

**67. Manufacturing betterment** is mainly a matter of applying the principles and practices described in foregoing pages to systematic improvement of conditions and processes. The progress made by others should again be carefully collected and studied. New inventions and devices should be tried out. Obsolete machinery should be replaced by the latest types. Labor conditions should be studied with a view to progressive improvement. An atmosphere of progress should be encouraged amongst all who will respond to it so as to make the work more interesting by linking it up with larger issues than mere routine. Nothing should be taken for granted but everything made subject to experimental investigation and measurement. Only in this way can the business be kept abreast of its competitors.

**68. Management betterment** follows the same lines but is concerned with the improvement of organization, system, and routine. In all these matters continual improvement is being made almost daily at the present time. The modern executive cannot afford to believe that his system is completed and unimprovable, because the standard in such matters is being constantly raised.

### CONCLUSION

**69.** The whole field of executive work has now been, very briefly, surveyed. Though at first sight it may seem to offer a formidable amount of detail to be studied and assimilated, this is, perhaps, more apparent than real. Throughout each of the great divisions of business that have been enumerated in the foregoing pages there runs a common thread of method. The mental processes and the ways of analysis and representation are much alike in all cases, although at first sight they appear very different. It will be well to master the first stages very thoroughly before taking up the later stages. If this is done it will soon be realized that very similar ideas are being presented in each case, and in very much the same way, only the things treated of are different. It is precisely the faculty of regarding a large number of facts and classifying and unifying them into a connected whole that is more important to the executive than anything else.

### EXERCISES

- (1) (a) What is meant by a layout, as applied, for example, to a shop or factory? (b) What is meant by the routing of a set of operations?
- (2) What is meant by the *budget* system?
- (3) (a) What are the practical stages in the process of acquiring materials? (b) Explain the nature of each such stage.
- (4) What are the principal points to be covered by the sales organization?
- (5) Describe two entirely different methods which may be adopted to increase the productive efficiency of the worker.

- (6) What can be done toward systematizing sales arguments?
- (7) (a) What is meant by locked-up capital? (b) What are some of the principal items that it includes?
- (8) (a) What is meant by labor turnover? (b) Explain how a reduction in the labor turnover means economy to the firm.
- (9) (a) What is meant by liquid assets? (b) Why is it essential for the executive to keep careful watch of the state of such assets?
- (10) (a) Name two reasons for exercising special care in fitting the employe to his job. (b) What are two of the principal things to be determined in order to make this fit as close as possible?

*Just copy the names*

## CHAPTER II

### THE NEW TOOLS OF MANAGEMENT

#### GRAPHIC REPRESENTATION

**1. Introductory.**—The preceding Section was devoted to a general survey of the field with which the executive must be thoroughly conversant. A number of separate items which were briefly referred to in that survey will now be taken up in detail.

**2. Counting and Measuring.**—There are certain things that can be counted, for example, dollars; there are certain other things that cannot be counted, but that can be measured, for instance, the length of a city block, or the area of a piece of ground, or the weight of a barrel of oil. The counting and measuring of various things is a constantly recurring and highly important operation in all kinds and in all branches of commercial activity. The result of a count (for example, of the contents of the till) is commonly recorded, committed to writing, by the use of certain symbols, which are called numerals, figures, or digits. The result of a measurement is a number, since measurement always, directly or indirectly, takes the form of counting, namely, counting the number of units contained in the thing measured. For example, if the carpenter measures a board with a foot rule, and finds it to be 50 inches long, this is merely a quick way of counting how many times a stretch of one inch can be laid off end to end along the length



of the board. Hence, measurements, like counts, are recorded on paper by means of numerals, figures, or digits.

Now, this use of numerals to represent, on paper, the result of a count or measurement, is not an unalterable thing fixed by a law of nature. It is simply a human invention, a convention, a method agreed upon by all who have learned to read and write; and because of this universal agreement, there is correspondingly universal understanding of the symbols thus employed. Everybody is so accustomed to this use of figures, the thought hardly arises that there may be other ways as good or, for some purposes, better, of accomplishing the same thing, namely, presenting to the eye a clear representation of the result of a count or measurement. To represent two numbers, one double the other, say 356 and 712, the use of figures is the usual way, and is perfectly precise and satisfactory so far as it goes. But when the numbers have been so written, the simple relation between them is by no means obvious. Only a seasoned accountant would immediately absorb the fact that these two numbers or quantities are in the ratio of 1 : 2, or, in plain language, that one is exactly double the other. And if the second number were to be 534, instead of 712, it is doubtful whether the relation between the two would be visible to any one, however versed in figures. But, more often than not, it is the *relation* between quantities that is the point of interest. Suppose \$5.34 is a selling price and \$3.56 is a cost price. It is obvious that the relation would be as important as the actual figures. The object of graphic representation is to bring out such relations. It effects this purpose by abandoning the representation of numbers and quantities by figures, and representing them by lines and curves instead.

**3. Representation of Numbers by Lines.**—The simplest way in which a number or quantity can be represented graphically is illustrated by the *line graph*, Fig. 1, in which a scale of centimeters appears. Now, if it is agreed that every centimeter shall represent the number 10, it is evident that any number can be indicated by drawing a line so many centimeters long; line *A* accordingly will represent 22.5 and line *B*

will represent 45.0. If it is desired to indicate 75, a line  $7\frac{1}{2}$  centimeters long would be drawn. But the actual value of the line depends on previous agreement. Suppose, instead of agreeing that each centimeter is to represent 10, it were agreed to let it represent 100. Then the two lines would have new values; *A* would represent 225, and *B* would represent 450.

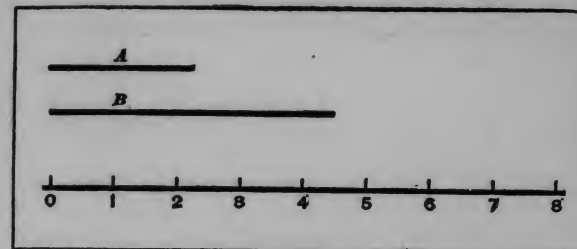


FIG. 1

The unit, or centimeter, might be made equal to 1,000 or 10,000 just as readily. The lines can, then, be read as follows:

<i>A</i>	<i>B</i>
22.50	45.00
225.00	450.00
2,250.00	4,500.00
22,500.00	45,000.00

according as the unit of the scale is 10, 100, 1,000, or 10,000.

**4. Representing Relations by Lines.**—One thing must be noticed in what has been given in the preceding article. Although the change of the value of the unit on the scale has magnified the numerical value of the lines *A* and *B*, the new values always have the *same relation* to each other. *A* is always one-half of *B*. This relation is very obvious in the chart, Fig. 1. Any one can see that *B* is double, or close to double, *A*. But if the table of values in the last article is consulted, this relation is not so obvious. Some momentary reflection, at least, is necessary before stating that each of the values listed under *A* is half that in the next column. Two things may therefore be observed in this very elementary case.

(a) Numbers can be expressed by lines (*line graphs*), provided that there is agreement on the value of the unit length (whether an inch or a centimeter, or the squares on a piece of squared paper, does not matter); (b) a relation between quantities persists to the eye, even though the value of the quantities is increased or diminished a thousand-fold or more. It is this last property of graphic representation that makes it so valuable. Quantity or number being translated into dimension, becomes and stays visible.

**5. Practical Use of Line Graphs.**—Even so elementary a form as the line graph has practical use. The spaces marked on the scale may, for example, represent seconds of time. On such a scale the history revealed by a time-study analysis may be set down in such way as to show at a glance the division of the operation into separate periods of different lengths. So, for example, Fig. 2 illustrates the use of a line graph to

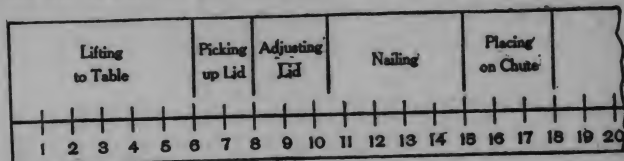


FIG. 2

record a time study of the operation of nailing lids on boxes. It will be noticed that in this case the scale is not based on centimeters or any other recognized measure. It is simply arbitrary, a scale spaced equally and the divisions numbered from zero up to any required figure. In this case a value of one second is assigned to each division of the scale. Glancing at the chart, it will be seen, that the first step, lifting the box, took 6 seconds; the next, picking up the lid, 2 seconds; the third, adjusting the lid, 2 1/2 seconds; the fourth, nailing, 4 1/2 seconds; and the final step, placing on the chute, 3 seconds. The relative duration of each of these steps is read from the chart at sight. Without troubling with the fractional figures, it is seen immediately that much time is required for the first step. One is struck with the fact that the time occupied in

actual nailing is only a small fraction of the total time consumed in accessory operations. It is not necessary to know the actual figures; the relative length of the several steps is the thing of prime interest, and this is recognized at a glance. That is where the great advantage of the graphic method lies. Relations are made visible and permanently recorded in a form that appeals immediately to the eye.

**6. Percentage Line Graphs.**—In studying an analysis of the type discussed in the last article, the relations between

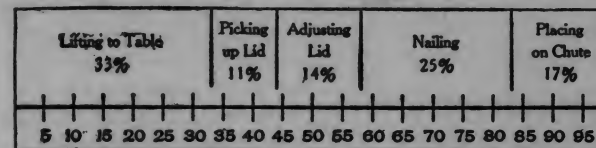


FIG. 3

the different steps of the operation will be more clearly seen if each of them is exhibited as a percentage of the total time taken. In Fig. 3 a line graph on a percentage basis is shown, covering the same data as Fig. 2. There are twenty divisions on the scale and a value of 5 per cent. is assigned to each division. The whole scale thus represents 100 per cent. The proportion of each step to the total time is then reckoned as a percentage and marked off on the new scale. It will be seen that the inferences drawn in the last article from an inspection of Fig. 2 are now even more easily reached.

**7. Percentage Circle Graphs.**—Percentage relations can also be exhibited by means of circular charts, in which the whole circle represents 100 per cent. Fig. 4

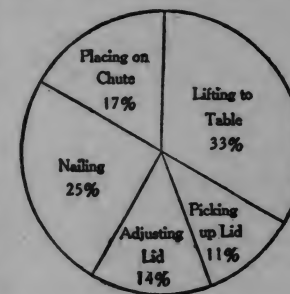


FIG. 4

illustrates such a chart, in which the data of Fig. 3 are arranged in circular form. This type of graph is especially suitable for expressing percentages, as it is impossible to



mistake the meaning of the chart. The circular chart is frequently used for representing the distribution of activities

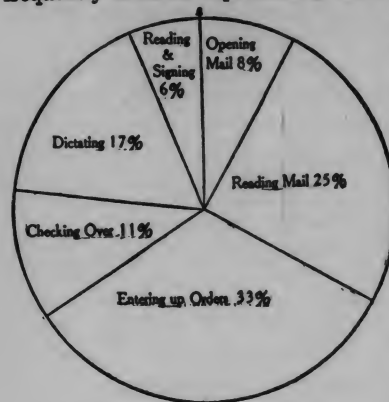


FIG. 5

toward a rearrangement of duties. In Fig. 6 the same type of chart is shown as applied to studying the average work of an office division, namely, a correspondence division. Here it is possible to observe, very clearly, the proportion of time devoted to the different kinds of work.

Work for the sales department has obviously the largest share, with form letters an easy second. It will readily be understood how such charts strikingly convey the salient facts of a situation. So, for example, on the basis of the facts exhibited in the chart, the sales department might

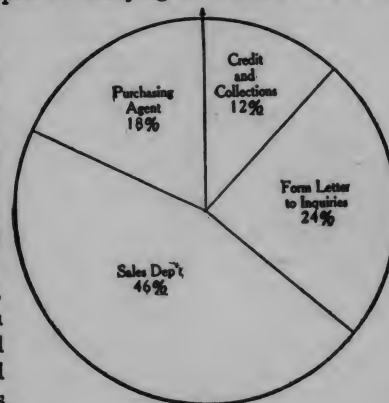


FIG. 6

put in a request for a correspondence division of its own, on the ground that most of the work of the existing division is occupied with sales matters. Sales plus inquiries are seen to account for about two-thirds of the work of the division.

put in a request for a correspondence division of its own, on the ground that most of the work of the existing division is occupied with sales matters. Sales plus inquiries are seen to account for about two-thirds of the work of the division.

**8. Two-Dimensional Charts.**—The charts described in the foregoing paragraphs make use of only one direction or dimension; that is, either of lengths measured off on a straight scale or of segments cut out of a circle. The field of utility of such charts is relatively limited. The exhibition of relations between quantities is much more fully covered by the two-dimensional charts now to be described. Their principle will first be explained. It has been pointed out that quantity or number can be represented by measuring off lengths along a scale. Now, suppose that it is desired to exhibit, not the relation of a quantity to its component parts, but its relation to another quantity. Suppose it is desired to indicate the time of occurrence, every day, of some particular event, such as the completion of a batch of manufactured goods. A horizontal scale of days is laid down, numbered 1, 2, 3 . . . , each unit representing one day, as in Fig. 7. Vertically over the zero of this scale a similar scale of hours is erected, with divisions, each representing one hour, numbered 1, 2, 3, etc. To indicate the occurrence of the event at 5 o'clock on the seventh day, a point is plotted vertically over the mark 7 on the horizontal scale of days, and horizontally across from the mark 5 on the vertical scale of hours. In this way, in Fig. 8, points have been plotted to indicate that the

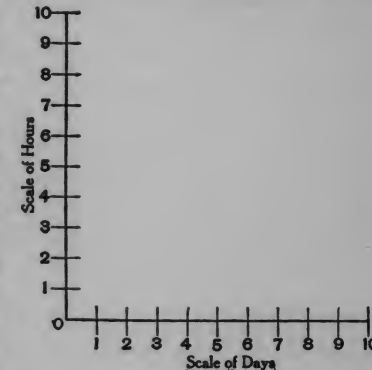


FIG. 7

particular event, such as the completion of a batch of manufactured goods. A horizontal scale of days is laid down, numbered 1, 2, 3 . . . , each unit representing one day, as in Fig. 7. Vertically over the zero of this scale a similar scale of hours is erected, with divisions, each representing one hour, numbered 1, 2, 3, etc. To indicate the occurrence of the event at 5 o'clock on the seventh day, a point is plotted vertically over the mark 7 on the horizontal scale of days, and horizontally across from the mark 5 on the vertical scale of hours. In this way, in Fig. 8, points have been plotted to indicate that the

event occurred on the first day at 2:30, on the third at 3:45, and on the seventh at 5 o'clock.

To facilitate the plotting of such points it is common to extend the division lines of the scales all the way across the paper, so that they form a network of squares, which aids the eye in locating the points to be plotted.

**9. Coordinate Charts.**—Charts such as those shown in Figs. 7 and 8 are known as *coordinate charts*, the two readings on the two scales, which locate the point plotted, being known as the coordinates of that point.

**10. Standard Form of Chart.**—While it is obvious that the scales might be arranged in other ways, the standard form of chart is that in which the vertical scale is on the left hand, and the horizontal scale at the bottom of the chart. Both read from the same zero, which is at the bottom left-hand corner. Charts representing statistical data are usually made in this form; but for business purposes, where the horizontal scale bears dates instead of simple numerals, the horizontal scale is

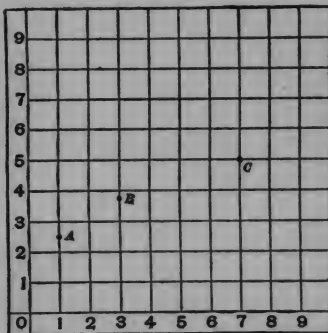


FIG. 8

often put at the top, following the practice familiar in the case of written reports.

It will be observed that the coordinate chart furnishes a means for visualizing the relation between two quantities, such as days and the hour of occurrence of a certain event, in the example given. A similar chart would represent the relation between any other two quantities, of whatever character. Thus, the horizontal scale might represent days, as before, and the vertical scale might represent miles, each division being equal to 100 miles. Then the dots A, B, and C, Fig. 8, might represent the distance covered by a motor truck.

The chart would show that the truck had covered 250 miles by the first day, had reached 375 on the third, and 500 by the seventh day. It will be seen, therefore, that the graphic chart is a universal language of relations, and that its readings depend on the values assigned to the scales.

**11. Curves.**—In a chart such as that shown in Fig. 9, on which have been plotted points representing the number of bags of product turned out in successive months, every two neighboring points so plotted may be joined by a straight line. In this way a continuous *curve* is obtained. It should be explained here, that in graphics, a *curve* is any line connecting a series of plotted points. It is not necessarily curved in the ordinary sense at all, but may, in some cases, be a straight line. The

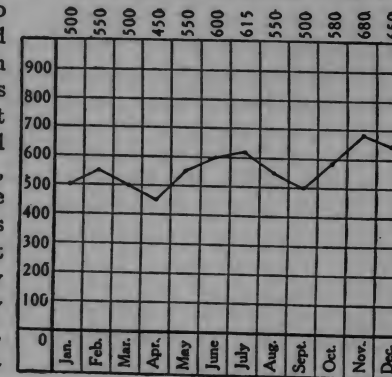


FIG. 9

word curve has, therefore, a technical meaning that must not be misunderstood. In Fig. 9 the curve is actually a very crooked line built up of a number of straight sections, but it is still called a curve.

**12. Cause and Effect.**—By the construction of such a curve as that of Fig. 9 the range of graphic information is extended. Inspection of the chart, without any reference to figures, shows that the curve representing the output is *periodic*; that is, it tends to rise and fall in a regular succession of waves. Furthermore, the crest of each wave rises higher than that of the preceding. Now, the first use of this observation is to arouse curiosity, to suggest a question. What is the meaning of this movement? In the diagram the actual figures are shown at the top of the chart for each month. A moment's

examination of these figures shows that from the figures alone the periodic character of the course of events, so plain in the curve, is by no means obvious. What, then, does the curve actually signify? Evidently it reveals some relation which finds expression in the wavy form of the curve.

13. One great advantage of representation by means of a curve is that such a curve plainly suggests to the eye and to the mind, not merely isolated facts or events, but a sequence, a succession, or a chain of such events, linked together in some way by causes that impart to the curve its particular shape. So, for example, a wavy curve like that in the illustration might be obtained if the maximum height of the water level in a tide basin were plotted for each month in the year. In this case some physical cause would immediately suggest itself as responsible for the wavy character of the curve. An explanation would, perhaps, be sought in the position of the earth relative to sun and moon, or in some other physical circumstance. But in the case of the output of a shop, does not the thought suggest itself that there must be some unknown condition behind the curve, which causes it to take the form shown? If, for example, a fairly uniform output had been expected, the form of the curve would suggest that conditions must exist somewhere to disturb the uniformity. It would also be evident that these disturbing conditions were not the same in every month, but were more active in some months than in others. That these conditions followed a regular cycle of activity would be manifest from the shape of the curve, with its regular crests and hollows.

The problem then arises of tracing the cause of the fluctuations. Perhaps this cause would be found in an irregular supply of raw material. Or it might be that the department under investigation was dependent for its material on another department which made a practice of piling up half-finished work for several weeks and then making strenuous efforts to get it finished and on its way, thus causing dearth at one time and superfluity at another. In this way an effort would be made to discover the meaning behind the curve.

The general idea of curves of this class will now perhaps be sufficiently clear. Whenever two sets of circumstances enter into a story the relation of one set to the other can be graphically expressed by first plotting points to exhibit the actual numerical relation, and then connecting these points by a line or curve. Observation of this curve will draw attention to forces tending to control the sequence of facts recorded, forces which it may become necessary to investigate.

14. **The Broken Chart.**—A coordinate chart, such as that in Fig. 8, ordinarily has the zero for both scales at the left-hand bottom corner. In many cases this would result in a very deep chart, in which the lower portion would not be utilized. An alternative arrangement is shown in Fig. 10. In this case it is required to show the divisions of the vertical scale as reading in intervals of 10, while the actual range of observations extends only from 110 to 180. Obviously this would make a chart of a depth many times its width, if the entire scale from 0 to 180 were drawn. In such a case the chart may be

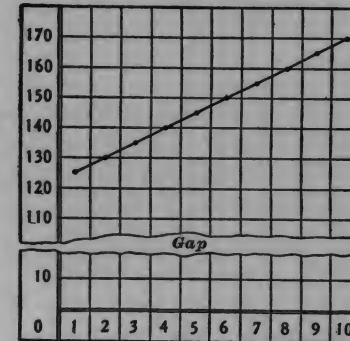


FIG. 10

drawn as shown. The zero is put in the usual place and one or two divisions are shown immediately above it. Then a break or gap is made in the chart, and the scale is resumed at any convenient point, so as to include the field that is wanted. In this case the field is from 110 to 180. The lower part of the chart (which remains vacant, the curve not extending into it) may also be omitted altogether. Showing the bottom of the chart and the gap above it has the advantage that it prevents any possible misunderstanding. When squared paper is used, a heavy, irregular black band may be used instead of a gap.

The curve shown in Fig. 10, by the way, is a straight line. It is straight because the relations shown throughout the chart are uniform. Each dot will be seen, on examination, to represent a value, on the vertical scale, exactly 5 divisions above the one before it and also 5 below the one after it. Thus, the growth of the curve being uniform, a straight line results.

**15. Vertical Bar Charts.**—It is often required to chart figures that do not refer to a sequence or succession of events in time. For example, it may be desired to chart, in wage groups, men employed in a plant, so as to show the proportion

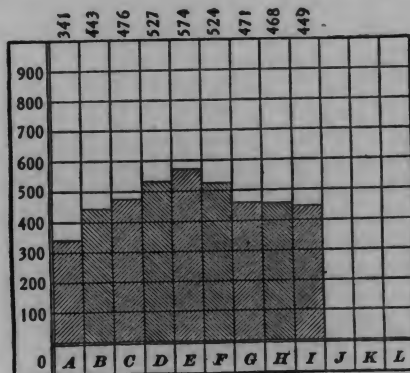


FIG. 11

of men receiving a given wage. A chart for this purpose is shown in Fig. 11. The vertical scale represents numbers of persons. The horizontal divisions represent the different classes or wage rates. It might equally well mean many other things. For example, *A* might mean native-born American employes; *B*, Italians; *C*, Poles; and so forth. Or *A* might mean men who had completed 10 years of service, *B* those of 20 years' service, and so forth. Any groups whatever can be represented by the horizontal scale without altering the form of chart. Then, in each column a line is drawn to represent the number of members of the class. The result is a diagram

such as that shown. The eye takes in at once the relative importance of the several classes.

**16. Cumulative Curves.**—Instead of plotting daily performances, the thing of interest may be to plot aggregate or total performance from a certain date forward, for example, since the first of the week, or the first of the year. A curve of this kind, which is spoken of as a *cumulative curve*, is shown in Fig. 12. The right-hand end of such a curve at any time

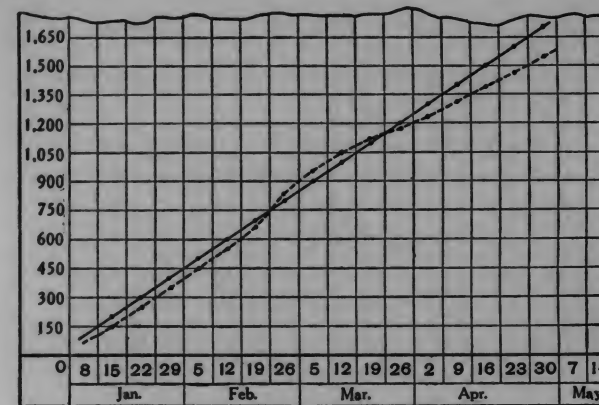


FIG. 12

indicates the result of the entire period covered. One important use made of this type of curve is to compare actual with expected results. If, to begin with, a curve is plotted, like the solid line in the illustration, to represent expectations, say, for instance, an expected output of 100 machines a week, then as the returns come in week by week, the actual output to date may be plotted as a dotted line, or in some distinguishing color, on the same chart. A glance at the chart will serve to show how far expectations are being realized. As shown, the results of the first seven weeks fall below expectations, then a brief spurt appears, lasting four weeks. After that there is not only a falling off but a general tendency to fall off further, as shown

by the fact that the solid and the dotted lines diverge more and more.

17. Another important use made of cumulative charts is to compare two sets of occurrences. In Fig. 13 a corner of such a chart is exhibited in which the business to date for two succeeding years is plotted. It will be observed that 1920 is running uniformly ahead of 1919 by a small margin. Many other relations can be shown in this way. One curve may represent new accounts opened, and the other old accounts closed. Or one curve may be plotted for value of orders received and the other for value of orders completed. In any

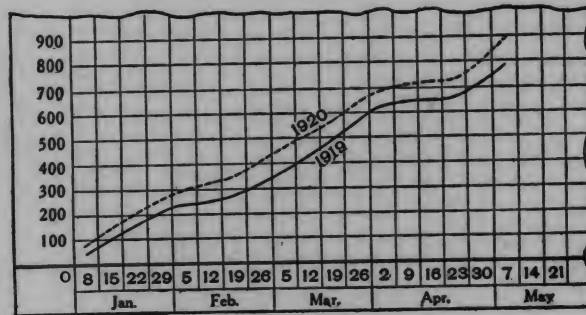


FIG. 13

of these cases a tendency for the curves to diverge would be a condition calling for executive investigation. In consulting a cumulative curve the fact that it is cumulative must never be lost sight of, otherwise erroneous deductions will be made. For this reason it is well to construct such charts on a paper of special tint, or the word "Cumulative" may be stamped with a rubber stamp in the top left-hand corner of the field.

18. **Limitations of Cumulative Curves.**—Cumulative curves can be made to apply only to a fixed period, such as the financial year, since they necessarily rise from a minimum at the first entry to a maximum at the final entry. Comparison with other periods can be made only in terms of an entire

period. That is to say, if the chart is drawn from January to December, it can only be compared with a similar chart drawn from January to December of another year. One of the advantages of the cumulative curve is that it irons out or flattens out fluctuations, and gives a steadier picture of the total results of the period to date. Its disadvantage is, as just stated, that it must always begin from zero at the beginning of each period; consequently it cannot be used directly (that is, without redrawing the whole curve from a new zero) for observation from half-period to half-period, or from July to June. To remedy this defect, what is known as a moving or continuous average is sometimes used.

19. **Moving Average.**—The cumulative curve represents, at each point, the sum of a steadily increasing number of components. A **moving average**, on the other hand, is one which corresponds, at every point, to the sum of the same number (though a different set) of components. Once started, a moving average goes on continuously, for as many years as desired, and any part of it is always comparable with any other part. The following table presents a series of data, which may be taken to represent, for example, sales per month, or factory output per month, or pay-roll figures, or, indeed, any kind of monthly statistics which it is desired to keep in view.

OUTPUT OF PLANT, MONTH BY MONTH

1919	1920	1921
Jan. 7,000	Jan. 6,500	Jan. 6,500
Feb. 7,500	Feb. 8,000	Feb. 7,000
Mar. 9,000	Mar. 9,500	Mar. 8,000
Apr. 9,500	Apr. 11,000	Apr. 8,500
May 11,000	May 11,500	May 10,000
June 15,500	June 14,500	June 13,500
July 12,500	July 10,500	July 11,000
Aug. 8,000	Aug. 7,000	Aug. —
Sept. 4,000	Sept. 3,500	Sept. —
Oct. 4,000	Oct. 4,000	Oct. —
Nov. 5,500	Nov. 5,000	Nov. —
Dec. 6,000	Dec. 5,500	Dec. —



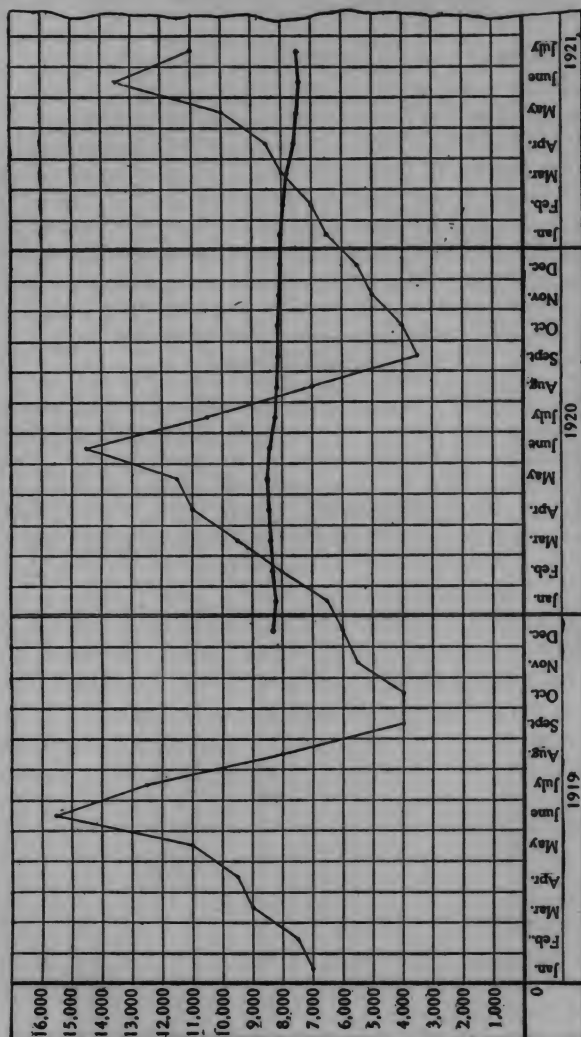


Fig. 14

20. In Fig. 14, these same figures have been plotted monthly, as shown by the lighter line. The seasonal character of the statistics will be obvious at a glance. The peak is reached in June of each year and the low point in September. It is assumed that business commenced in January, 1919, and therefore a moving average based on twelve months cannot be commenced until December of that year.

At the end of the year 1919, however, an average of the twelve months is struck and plotted on the chart. This forms the first term of the moving average. In January, 1920, a fresh calculation is made, deducting from the total output the figure for January, 1919, and adding that for January, 1920, and striking a new average. The new figure is then plotted and joined by a line to the previously plotted average. Each month the same procedure is followed. The newly completed month's figure is added to the total and the figure for the first month of the series is subtracted. The new total is divided by 12, and the resulting figure is plotted. The heavy black line so obtained shows at any moment what is the average for the last twelve months. It will be seen from the moving average that conditions taken over a period of twelve months are fairly steady. Notwithstanding the wide fluctuations from month to month, the business per twelve months is remarkably uniform, the oscillations hardly amounting to 1,000 units, while the extreme fluctuations of the monthly figures range over no less than 12,000 units. It may be noted from the moving-average curve that volume of business has shown a slight tendency to contract, but in the latter part of the period covered indications of recovery are apparent. Should the curve, however, in the subsequent course of events, begin persistently to fall, this would be an indication that adverse conditions were setting in; and similarly, should it persistently tend to rise, better conditions would be indicated. A curve of this kind necessarily conveys the information much more quickly and surely than a mass of statistics labored over with pencil and paper.

## ANALYSIS

**21. The Shortest Path.**—Although the general idea of studying economy in productive processes by means of analysis is not new, this method has been so enormously developed in recent years that it may fairly be regarded as a new instrument of executive control. The reason of its importance and its success will be understood when it is considered that not merely industry but most human occupations are made up of innumerable small steps. Applying this to industry, it will be realized that the business day is filled by a succession of acts and movements each of which should be so designed as to advance matters toward the end in view. The modern use of analysis is simply a frank recognition of the fact that most of the steps taken in every-day life are performed by unconscious habit. Few of the things done habitually are the result of deliberate study and training founded on study. Hence it often happens that when a systematic study is made of any given sequence of steps, they are found to be far from that logical arrangement which should lead by the shortest economic path to the end sought.

**22. Varieties of Practical Analysis.**—The application of analysis to business matters takes a variety of forms. The first and most common is *time study*. Here the performance of a given task is reviewed from start to finish, and the separate steps of it are distinguished and numbered in sequence. Each step is then carefully timed by repeated observations, taking the average of the series of such observations. The analysis can be carried further, dividing each step into individual motions, and timing these by special methods. Such detailed analysis is known as *motion study*. Motion study, as applied to the case of the nailing operation discussed in preceding articles, would probably commence by an examination of the motions that make up the first step, lifting the boxes. Each movement of the operator would be set down, care being taken to classify the motions in such a manner that the first move-

ment leaves off precisely where the second begins. The series should show the same total time as was observed for the whole step. Thus, all the motions in the first step should aggregate 6 seconds. When all the motions have been listed and the observed time of each tabulated, the next step is to study the results with a view to determining whether all the motions are necessary, or whether perhaps one or more of them can be eliminated, or whether other motions can be devised that will perform the step in less time and with less effort. Other considerations than those of the actual motions will enter into the problem. The point of delivery of the cases may be too far from the table. It may be too low. It may be at the wrong angle, and so on. Rectification of the unfavorable conditions will depend on the exercise of creative thought, after the motion study is completed. It should be noted that the analysis and its quantitative results are only a means to an end. It provides the materials for an accurate judgement, but does not in itself effect an improvement.

**23. The Quantitative Element.**—It should be observed that the main object of time and motion study is to make a quantitative determination of certain observed steps and motions. The whole trend in industry is toward substituting measurement for empirical or arbitrary estimate of values. Suppose that, as in the nailing operation referred to, no study had been made to determine the reasonable output per day in work of this kind. A casual observation might lead to an arbitrary judgment that 200 boxes per hour was a fair average. But an assessment of this kind possesses no quantitative value. It is a mere guess, even though made by a person of experience. To render a judgment in quantitative, exact terms, measurements must be made. An actual record or count of the average number turned out per hour provides the facts as to what is actually happening, but is no guide as to what can and should be accomplished. The only way to obtain this information, obviously, is to analyze the work into its constituent steps, and attach a quantitative value, that is, an exact observed value, to each step.

**24. The Sphere of Time Study.**—From what has been said in the preceding articles it will be understood that time and motion study is no magic wand by waving which over the industrial situation great improvement can be immediately attained. On the contrary, the good to be extracted from it will depend entirely on the intelligence brought to bear on the situation revealed by the analysis. No method of analysis does more than provide facts. The use made of these facts will determine the success or failure of the method. Great opposition has been made to time study by trades unions, but this has been due to the injudicious use made of the data collected. To oppose time study as such is as absurd as it would be to object to the use of a caliper gauge, or any other fine measuring instrument in the course of the work. Nevertheless, this tendency for opposition by labor should be kept in mind by the executive. The introduction of time study should always go hand in hand with increased remuneration based on an increased output, and care should be taken that mere speeding up is not made the pivot of this increased output. The real sphere of time study is to make work easier and more pleasurable, by which means both quality and quantity are increased. This can be done most satisfactorily when the idea has been sold to the workers beforehand, that is, when they are shown that it works for their own financial advantage—a process which demands tact and a spirit of mutual accommodation, not always easy to promote, but priceless when it is once established.

**25. Fatigue Study.**—Fatigue may arise from at least two different causes. The first and most obvious is the continued exercise of one set of muscles or nerves, by which a strain is set up without opportunity for relaxation and recovery. The tired feeling is due to the accumulation of poisonous by-products in the tissues beyond the power of the blood to carry away. By resting the muscle, opportunity is given for such poisons or toxins to be absorbed, and renewed energy is then set free to act. The old saying that change of work is as good as a rest, is thus fully confirmed, subject to the reservation

that the new work must be energized by a different set of muscles and nerves from the old. Fatigue study is directed to ascertaining at what point fatigue sets in, and the necessary amount of rest and change that will dissipate it. Another species of fatigue is due to unsuitable or cramped attitudes. While fatigue of the first class is a matter for study and investigation by trained experts, the second species can be eliminated in a large measure by the application of ordinary common sense.

**26. Eliminating Fatigue.**—One of the most common sources of fatigue is the use of unsuitable chairs and stools for the worker. The first practical attention to this was given by the typewriter makers, who early discovered that, for the best results, the operator's elbows should assume a certain position with reference to the keyboard. Adjustable typewriter chairs were then devised. The same principle applies everywhere. For the best results, the height of a chair or even of a table top should be adjusted to the person using it. This applies equally in the shop and in the office. Moreover, it is found that in many cases where the work is continuous, uniform, and wearisome, it pays to provide facilities whereby a sitting position can be exchanged for a standing one. Though expert training in fatigue study will bring results most quickly, much may be done by common observation. Where any worker is seen to be placed in an attitude that is not easy and well balanced, it is safe to say that such worker is not able to give the best output of which he or she is capable.

**27. Job and Vocational Analysis.**—Another variety of analysis is directed to fitting the capabilities of the worker to particular demands made by the job. The problem here presented comprises two steps, namely, the elimination of the unfit and the selection of the fit. A simple and well-known example of elimination of the unfit is the physical examination of candidates for responsible positions at sea and as locomotive engineers. Color-blind persons, who can not distinguish red from green, are manifestly unfit for such positions. On the other hand, as an example of selection of the fit, many large

firms now try out candidates for office positions by simple tests, so as to discover and segregate those who are good spellers, and adept in the use of English, those who are naturally good at figures, etc. The selection of employes is expert work and should be entrusted to specialists trained in a psychological laboratory.

### PRINCIPLES OF LAYOUT

**28. Object of Studying Layout.**—The object for which equipment is assembled is production. This implies the receipt and storage of raw material, and the conducting of this material through various departments and machines whereby it is gradually changed into finished product. Just as the minute details of a process may, under analysis and time study, be found in need of modification, so it is frequently found when the path, or routing, of material and product is studied and analyzed, that the arrangement of buildings and equipment is by no means the best that can be devised, and that very considerable economic loss is being incurred under the conditions as they exist. Just as a process or manipulation should consist of as short steps as possible, so it is also true that the route taken by material and product should be as short as possible, and, what is even more important, it should involve as few handlings as possible.

**29. Method of Study.**—In order to ascertain the exact conditions under which the plant is working, the existing layout must be reduced to the form of a plan. Usually a large-scale plan of the whole plant is first made, and on this templets or small cards, cut to the shape of the various pieces of equipment and machinery, are pinned in the positions which they occupy in the plant. The next step is to study the actual route taken by the material, from its reception at the gate to its final stage as finished goods. This may be done by laying colored cords from one stage to the next, marking all stopping places and rehandlings by suitable signs. There is thus obtained a picture not only of the arrangement of the plant but also of the entire path of the material and product,

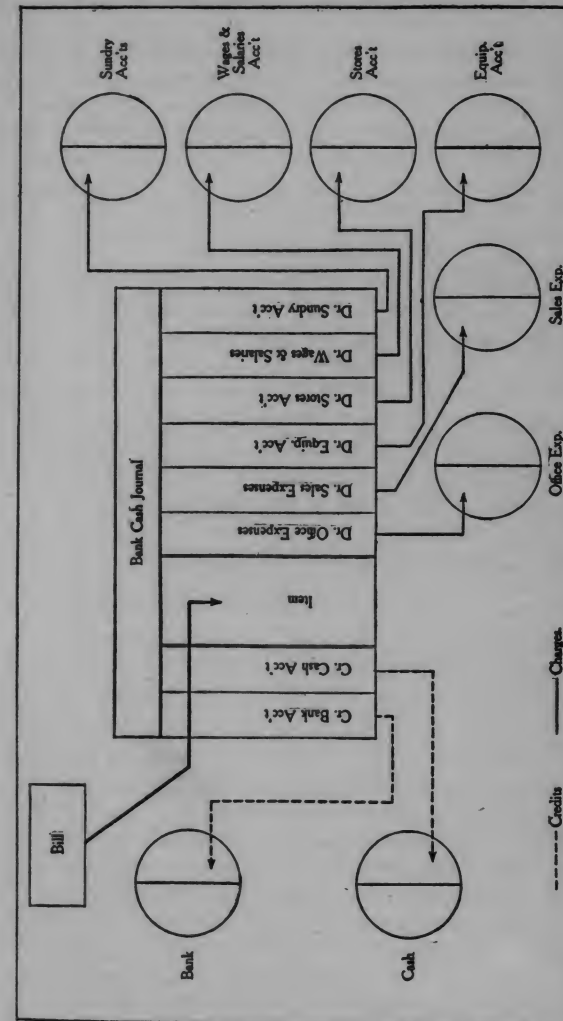


FIG. 15



or, as it is termed, the flow of goods. A careful study of such a plan, with the lines of flow indicated upon it, usually suggests rearrangements, either in the machinery or in the direction of motion, by which economy of time and movement can be effected.

**30. Routing Applied to Office Work.**—The principle of layout and routing can be applied not only to the movement of material in a manufacturing process, but also to any business organization considered as a series of centers through which there is a flow of orders, instructions, and information. Each stage can be mapped, and the flow of papers and instructions followed up, just as the movement of material was followed up. In fact, any process or activity made up of stages between which movement takes place can be studied by this method. This can therefore be applied to charting the relations of bookkeeping. Each journal is a starting point from which two movements take place, a credit going in one direction and a charge in another. In either case the end of the path is a ledger account. Hence, it is an easy matter to adopt certain symbols to represent journals and ledgers and colored lines to represent debits and credits. In this way the whole of a bookkeeping system, including cost accounting, may be mapped or charted. The movement of values of all kinds can then be followed, and any question that may arise can be solved with greater ease than where no such chart of the system exists. Fig. 15 shows a very elementary group of accounts charted by this method.

**31. Accounting Charts.**—In charting a system of accounts, ledger accounts are represented by circles bisected by a line, the two half circles thus representing the debit and credit side of the account, respectively. Journals are represented in much the form they take in actual fact. Then green lines are used to connect the charge side of ledger accounts with the proper journal column and red lines connect the journal with the credit sides. In the illustration red lines are replaced by dotted lines, and green lines by solid black lines. Original documents like bills, invoices, orders, consignment notes, etc., are represented by rectangles, and their relation to journals is

indicated by heavy black lines. In constructing a chart of accounts, it is important to allow plenty of space around each of the symbols, otherwise the path of the lines cannot be clearly seen. Considerable study is also necessary to arrange the various blanks and ledger circles in a convenient relation to one another on the chart so that few crossings of lines take place. Charts of this description are especially useful in training clerks so that they may have an intelligent comprehension of the work as a whole, and thus may be transferred from one class of work to another without loss of efficiency.

#### VISUAL CONTROL

**32. Classification.**—Visual control is of four kinds, the simplest form being that which deals with indication of future happenings at a definite date. The second form deals with the management of a sequence of jobs in reference to future dates and current progress. The third has to do, not with time, but with capacity. The fourth is concerned with space, and is commonly performed by means of maps.

**33.** An illustration of the first type of visual control has already been given; it was suggested that making a mark on a displayed calendar was a method of visual reminder for the performance of a certain duty on a given date. Note, however, that the use of a calendar *in full sight* is implied. A note in a diary does not fulfil the conditions. The fundamental form of visual control of the first type is a suitable blank, frame, or board, provided with suitable movable symbols to call attention to various duties to be performed on assigned dates, corresponding to definite spaces on the board. Visual control in industry is much more often of the second type, in which not merely isolated facts are indicated, but whole series of connected facts are planned out on a time scale, and a daily check made to observe whether actual happenings correspond with the intended sequence or program. In case they do not, then it is necessary to make alterations in the arrangement



of the symbols so as to bring them into close relation with what has actually happened. This implies also that a quick modification of the program can be made. If certain things

Jan. 5	Jan. 7	Jan. 9	Jan. 15
ENGAGE TRAFFIC MAN Advertise in N. Y. Papers ✓ Write J. L. P. for his Advice ✓ Draft our Requirements for this Work	BELGIAN TRADE Write U. S. Consul at Bruges ✓ Inquire of M. Co. as to Customs requirements ✓ Quotations for Translating our list B16	NEW ABRASIVE FOLDER J. W. to Draft ✓ Select Cuts ✓ To Printer ✓ First Proof Final OK Order 10,000	SMITH & CO.'S COMPETITION Write Wilson ✓ Talk with Redgrove ✓ Suggest change in No. 3 device at Board Mtg.
			INSURANCE RATING Write to B. Co. for rating on New Kiln ✓ Consult with Trudale as to Dividing Wall on East Side

FIG. 16

have failed to happen as planned, it is obvious that they must be set back on the program, until they do happen.

34. An elementary form of visual control board is illustrated in Fig. 16. The shaded portion represents a wooden frame in which cards can be inserted, and their position changed by shifting backwards and forwards as required. Above the main cards are smaller cards bearing dates. These also can be moved and changed at will. The drawing may be considered to illustrate a small private control board for the use of the executive. Each card represents some particular item of work that he has in hand. When he takes up a new item he makes out a heading for the card, and puts under it the various steps to be performed, letters to be written, persons to be interviewed, information to be sought, etc. When filled out, the card is inserted in the frame, under the date at which the whole operation should be completed. In some cases, however, the executive may not desire to take any steps in the matter at the time. In that case the card is inserted in the frame at the date on which he intends to make the first move in the matter. Then, as each step is completed, a mark is made to indicate that it has been attended to. A rubber date stamp may be used for this purpose if desired. The elementary idea thus illustrated can be expanded to any desired extent for practical use. The frame should be large enough to hold a number of cards over a reasonable range of future dates. As soon as any piece of work is completed the card is taken out, thus leaving only live cards in sight.

35. As an example of the third type of visual control consider a 50-gallon tank, fed at irregular intervals with a gallon of liquid at a time, and drawn upon also at irregular intervals. A simple and efficient method to keep a visual record of the contents of the tank at any time is to provide a scale 50 inches long, upon which cards 1 inch long can be attached. As many 1-inch cards are placed end to end upon the scale as there are originally gallons of liquid in the tank, and thereafter a card is added or removed at the end of the scale every time a gallon of liquid is fed to the tank or drawn from it.

In this way a glance at the scale immediately shows the contents of the tank in gallons. This simple example illustrates

visual control as applied to capacity, or, in common parlance, to loading.

**36.** Excellent use of visual control can be made with regard to operations covering a more or less extended geographical territory. Pins with large colored heads are inserted at different points to indicate such items as customers (a color for each particular product, say), agents, sources of supply, etc. Lines (for instance, red cord) drawn between two or more pins may indicate salesmen's routes, or lines of shipment, etc.

#### MECHANICAL AIDS

**37. Recording Time.**—In all industrial operations, time figures prominently as one of the factors to be reckoned with in making for economy and success. Two kinds of time records are commonly made. The first kind is a record of the total time spent by employes within the premises of the enterprise; the other is a detailed record of the way in which this time is divided up among the different jobs worked on. In a plant of any size, time recording should be based on a master clock of the highest quality, electrically connected to all the subsidiary recorders of either class. At each entrance to the premises a time clock and card rack should be arranged on which every employe records his time of arrival and departure. The card thus bears an accurate record of the time spent by the employe in the plant or office. This record is sometimes referred to as *gate time* and sometimes as *pay-roll time*, since it is usually the official record for calculating earnings, subject to the detail record, next to be described, agreeing with it as to the total time accounted for.

**38. Job Time and Elapsed Time Records.**—The total or wholesale time record has, in the case of operatives at any rate, and sometimes in the case of clerks also, to be checked and accounted for, by what may be termed the detail record, that is to say, by an itemized account made out for each employe, showing how each minute of the total was used.

To accomplish this, a variety of devices exist. In general, they are based on the principle of the time stamp, electrically connected to the master clock. The job ticket or work order is put under the stamp when the job is commenced, and receives an accurate imprint of the starting time. On completion of the job, it is again put under the stamp and receives an imprint of the finishing time, in plain figures, and usually under the starting time entry, ready for the subtraction to be made. The remaining calculations, namely, the finding of the working time, and its valuation at the wage rate, are done mentally in the usual way. There are also devices which directly record the elapsed time, that is, the working time between start and finish. They thus save the operation of subtraction. This is, however, not so great an improvement as it seems, for this type of device does not give the elapsed time in plain figures, but by means of an imprinted clock dial, or, in some cases, by a notched scale. It is probable that the plain time stamp electrically connected to a master clock is the most serviceable device for a large plant.

**39. Time Stamps.**—Time stamps, similar in principle to those used for time recording, but differently constructed so as to allow documents of all kinds to be stamped, are in frequent use in large plants, where there is a continuous flow of papers and documents between one office and another. As soon as a paper is received by an office, the first act is to put it under the time stamp, so that its course can be followed, should any question of improper delay arise. In some cases the outgoing time is stamped in preference to the time of arrival. This is on the whole a better method, since the stamp then shows the latest hour at which the forwarding office had possession of the document, and on arrival at the next office this time is checked so that delay in transit is discovered at once. Likewise, should the document have been detained in the first office after stamping, the receiving office will check that fact. As it will not care to assume responsibility for the delay, the paper will be taken back to the first office for correct stamping, and the responsibility will thus be cleared up at once. Incom-

ing letters from the mail or other source should be time stamped at the moment of their arrival, whichever system of time stamping is followed.

**40. Counting Devices.**—Counting appliances are very numerous, both in type and in the uses to which they are put. In general they are used as a check on operation. As a rule their action depends on counting the revolutions of some axle or shaft, but sometimes actual working strokes are counted instead of machine motion. Such counters are of three main types—dial counters, of which the speedometer used on automobiles is the best known example; graphic recording counters, in which the record is traced on a card or ribbon, detached at intervals for study; and electrically connected counters, in which the record is made at a distance (say in the office of the superintendent) from the machine whose record is being taken. There is no doubt that, in most industries in which operation is more or less intermittent, it will pay to attach a recorder to every operative machine, and to make the records a matter of careful tabulation and charting. Counters making their record on cards are also used on road trucks. Every stop made by the truck is recorded. If intelligently used, such recorders are of great assistance in planning out work for a fleet of trucks and controlling their operation.

**41. Metering.**—Just as counters are related to working machines, so meters are related to anything that flows, whether fluid or gas in a pipe, or electricity in a wire. The importance of metering gains in proportion as exact methods of cost keeping are introduced. Also it becomes of prime importance where bonus systems dependent on savings are put into operation. Meters can be applied to the measurement of the quantity of steam, gas, compressed air, water, and electricity supplied to departments. In cases where any of these services form a large item of cost, it is evident that a control of their wastage is all-important. And if bonuses are based on saving and avoidance of waste, it is necessary to have accurate figures as to what has actually been done, so as to avoid disputes and loss of confidence in the fairness of the bonus calculations.

Moreover, in large plants, great waste is liable to occur in the absence of proper metering. A case may be cited where, in a large steel plant, the simple introduction of a meter costing a few hundred dollars effected a saving of five thousand dollars the first year in the steam consumption of one large shop alone. In the absence of metering by departments the relative amounts used are a matter of guesswork disguised by calculations; all that is really known is the total consumption of the plant, and this information is nearly always insufficient to give any real clue as to whether departmental consumption is justifiable or not.

**42. Temperatures and Pressures.**—In certain industries, temperatures and pressures have to be accurately controlled. The success of operations may depend on the maintenance of uniform temperatures and pressures for a series of hours or even days. In such cases some device for indicating temperature and pressure is essential, but more than indication should be aimed at. In all instances *recording* devices should be installed. These either make their record on a card at the place of observation or they may be electrically connected so that the record is made at a distant point. Where employees are responsible for the maintenance of prescribed conditions it is important that the records should be open to them. An interesting practical demonstration of what can be accomplished in this way has been furnished by an occurrence reported by a leading sulphite pulp manufacturer. The product at one time gave much trouble through lack of uniformity, with consequent depression of sale price. This condition was overcome by installing temperature and pressure recording devices, and educating the workmen in the meaning of any departures from the proper curve. This arrangement not only furnished the mechanical means for effecting regulation, but was found, furthermore, to react upon the minds of the workmen, who developed an entirely new interest in their work which was thus brought within their intelligent control. In a short time a great improvement in uniformity of product was secured, at a negligible cost.

**43. Arithmetical and Statistical Aids.**—All the foregoing mechanical aids are concerned with the origination of records. It remains to consider a series of mechanisms that assist in the working up and digestion of the figures and values so recorded. Such appliances may be divided into four classes, according to the end served by each. Although the main outlines of each class are fairly distinct, yet there is a good deal of overlapping, owing to the fact that even the most intricate calculation is based on two simple processes, namely addition and subtraction. All other arithmetical processes are derived from these two, multiplication being nothing more than a convenient method of repeated addition, and division being merely repeated subtraction. This is not only true theoretically, but nearly all calculating devices do actually perform their multiplication by repeated addition and their division by repeated subtraction. Hence, almost any machine that can perform one of these operations can also perform the others. Nevertheless, each machine has its own special field, since it performs certain operations more readily than others. The various machines on the market can, accordingly, be classified under four types:

(a) Adding and listing machines; (b) calculating and arithmetical machines; (c) bookkeeping and billing machines; (d) tabulating or statistical machines. Each of these classes will now be briefly described.

**44. Adding and Listing Machines.**—A good deal of misconception exists as to the relative value of adding and of listing machines. The former add without printing either the figures added or the answer; the latter print both data and answer on a long slip of paper. It is frequently claimed by manufacturers that extra accuracy is obtained by listing. This is not so. To secure accuracy the list must be checked against the original figures, and there is just as great an opportunity for error in making the comparison as in repeating the addition. The disadvantage of the listing machine is that it is much slower than a simple key-type adding machine, inasmuch as it is necessary to work a lever after every item in order to

print. In some cases, however, the record made by the listing machine is of great value. Where documents are sent from one department to another, the accompanying slip will show the individual values and also the total. If goods are being dispatched, the list will give the individual weights of the cases, and also the total weights. Wherever, therefore, there is a use for the list as a document, this type should be adopted; otherwise the free-keyboard type should be given preference. By a free-keyboard machine is meant one in which it is not necessary to pull a lever after every item. In some cheap non-listing machines the keyboard is not free; such machines should be avoided unless price is a paramount consideration.

**45. Arithmometer Machines.**—With practice an adding machine can be used quite efficiently for multiplications. Nevertheless, where much calculation of a mixed character has to be done the arithmometer type of machine, which performs multiplications and divisions by a single turn of a crank (in the highest type machine, an electrically driven spindle), is much preferable, almost indispensable. Some machines combine, in a certain degree, the advantages of a keyboard adding machine with those of an arithmometer calculating machine. A good equipment for an office where the bulk of the work is addition, together with a fair quantity of multiplication and division, consists in a small free-keyboard adding machine, and a keyboard arithmometer machine. Both can be used for addition, and for small figures the adding machine can be used for multiplication and percentages, while any bulk of multiplication, division, or higher arithmetical calculation can be performed on the arithmometer, no special skill being required.

**46. Bookkeeping and Billing Machines.**—In the machines just described, either no printed record is made at all, or such record is confined to figures and symbols. Many of the operations of business, however, demand a combination of figuring and writing. In other words, the combination of an adding machine and a typewriter is an obvious want. Two classes of such machines are in use. In one, the adding mechanism is distinct from the typewriting mechanism as



regards the printing of results. The striking of a figure key sets the adding mechanism in motion, but the result shown in the dials has to be written by striking the typewriter keys. This type of machine has been highly developed. A number of individual adding mechanisms can be used at one time on the same writing machine, with one set of typing keys, thus permitting the compilation of columnar statements of large size. Regular bookkeeping operations are also performed on such machines, extra figure mechanisms recording the totals of debits and credits so as to provide a check on the accuracy of the work. No accounting department of any size should neglect the use of machines of this class, which are applicable equally well to stores accounts and to ordinary ledger accounts.

The second class of machines do more than those just described. They are known as billing machines. Such machines combine a typewriter with a complete calculating and printing equipment. Bills may be written, prices entered, extensions figured, totals made, and discounts deducted, all in the ordinary process of making out an invoice. The machine does all the work automatically. Such mechanisms are, naturally, very costly, but whenever sufficient work exists to keep one fully employed it should be adopted. Both accuracy and speed of work are greatly increased.

**47. Tabulating and Statistical Machines.**—Where a large mass of data are to be classified and tabulated, an ingenious device, first used in connection with census work, is the most efficient means to employ. The principle of this machine is best explained by an illustration. A card, such as that shown in Fig. 17, has printed upon it a series of columns of the digits running from 0 to 9. The card is divided by vertical rules into fields, each field being assigned to a particular class of facts. For example, in a census enumeration, the first field may be given over to the classification of the population according to age. In classifying such characters as country of birth, marital condition, etc., a code must be adopted by which each item can be represented by a number. So, for example, in classifying native country, the United States

might be designated by 1, Great Britain by 2, etc. Inasmuch as the highest age recorded will never greatly exceed 100, three columns of digits will suffice for the field on the card used for the age record. Sex being confined to one of two figures, one column suffices for the sex field. The same is true as regards color. Marriage status presenting four alternatives, one column will also suffice for this. The general principle is that as many columns must be assigned to each field as the maximum number of digits that will occur in the class of facts to be recorded. For figures not exceeding 9, one

Age	Sex	Height		Weight	Country of Birth	Nationality	Color	Marital Status	Number of Dependents	Occupation	Income Per Annum
		ft.	in.	lbs.							
0 0 0	0	0	0	0	0 0	0 0	0 0	0 0	0 0	0 0	0 0 0 0 0 0
1 1 1	1	1	1	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1 1 1 1 1
2 2 2	2	2	2	2	2 2	2 2	2 2	2 2	2 2	2 2	2 2 2 2 2 2
3 3 3	3	3	3	3	3 3	3 3	3 3	3 3	3 3	3 3	3 3 3 3 3 3
4 4 4	4	4	4	4	4 4	4 4	4 4	4 4	4 4	4 4	4 4 4 4 4 4
5 5 5	5	5	5	5	5 5	5 5	5 5	5 5	5 5	5 5	5 5 5 5 5 5
6 6 6	6	6	6	6	6 6	6 6	6 6	6 6	6 6	6 6	6 6 6 6 6 6
7 7 7	7	7	7	7	7 7	7 7	7 7	7 7	7 7	7 7	7 7 7 7 7 7
8 8 8	8	8	8	8	8 8	8 8	8 8	8 8	8 8	8 8	8 8 8 8 8 8
9 9 9	9	9	9	9	9 9	9 9	9 9	9 9	9 9	9 9	9 9 9 9 9 9

FIG. 17

column suffices, for figures exceeding 999, but not attaining 10,000, four columns, and so on.

The first step in using the tabulating machine is to place the cards (one for each person enumerated in the census, for example) in a punching machine. This machine has a little keyboard like the keyboard of a typewriter, but bearing only the numerals from 0 to 9. On pressing the 8 key, for example, the figure 8 in the second column is punched through and replaced by a round hole. On pressing again, say the 6 key, the figure 6



in the third column is replaced by a hole. The age 86 has thus been punched in the card. Similar procedure with the other facts will result in the figures of the original record being now represented by a series of holes punched in different fields in the card.

After the cards have been punched in this manner, with as many items as desired (and as each card will hold), they are next put in a sorting machine, which automatically, and with great speed, picks out all cards bearing certain selected punch holes. In this way, for example, out of the total population, the cards of all persons of a selected age or age group can be very quickly selected. The cards having been thus selected are put into a third machine, a counting and adding machine. This not only counts items of a given class, but, in case certain items are numbers (for example dollars, and cents), it will add these items and register the total on a dial. Several such dials are provided, so that the machine can perform a number of operations at one time.

**48. Tabulating Business Statistics.**—While the foregoing description will probably suffice to illustrate the principle of the tabulating machine, and the kind of information it is capable of affording, something may be said about the classes of business statistics to which it is best adapted. The machine is valuable in proportion to the number of facts collected about the unit transaction (that which appears on *one* card). The power of the machine lies in its automatic sorting, while its weakness lies in the cost of punching the cards. Consequently, if only three or four facts are known about the unit transaction, it will usually be better to sort and combine by hand, and to sum up with an adding machine. But where more than three or four data are collected, and especially if conditions are such that statistics may suddenly be called for long after the transactions have taken place, then tabulating should be resorted to. Provided the cards are in existence, the capacity of the machine for quickly working up new statistics is enormous. In large firms, therefore, where boards of directors are apt to call suddenly for new kinds of statistics at short notice,

all cost and sales transactions should be committed to tabulating cards and the whole statistical system based on the tabulating machine. Wherever it is applicable at all, there can be no doubt of the immense value of the additional power over statistics that it gives.

**49. Communication.**—In the small-scale business of former days the question of intercommunication hardly arose. Every one was, so to speak, next door to every one else. But today this is no longer the case. Establishments of moderate size require a properly organized system of intercommunication, which may take various forms. In the first place, verbal communication has to be established by means of internal telephone systems, dictagraphs, or writing-telegraphs. Provision has to be made for summoning officials who are liable to be in any part of the plant. This may be effected by audible calls or by a system of colored lights. Next the inter-transport of papers, drawings, and documents has to be provided for. This can be done by means of pneumatic tube systems, or by mechanical carriers that pick up papers and books and set them down at desired points, or, in the case of short distances, by basket carriers running on wires. A few remarks will be offered on each of these methods of intercommunication.

**50. Internal Telephone Systems.**—The more extensive the business, the more important it becomes to provide every official whose duties demand intercommunication with others, with a desk telephone. Plant telephone systems are of two kinds, one being entirely local and not communicating beyond the plant and offices, the other being a rented extension of the public exchange system. While the latter system is the most complete, it has two disadvantages. First, all the traffic passes through the plant switchboard, involving considerable operating expense; and second, the yearly rentals of a large number of instruments mount up, and cannot very well be cut off in slack times. The purely local system has the disadvantage that the public exchanges cannot be reached by it. The middle course is to adopt both systems, confining the use of the public exchange to such officials as actually require it

constantly, and putting all officials on the local system. This means that certain of the more important men have two instruments, one for public use and one for local service, but this slight drawback may be disregarded. In some cases where constant communication goes on between certain men or departments, direct wires unconnected with the regular system should be installed. The expense of apparatus is negligible, even if only a small amount of time is saved to busy men.

**51. Personal Code Calls.**—It frequently happens that the man wanted is not in his office when a call is received for him. In a large business he may be in any one of twenty places. The problem of locating him is therefore important and is usually met by establishing a system of audible or visual signals, set going by the operator receiving the call. Such signals are placed in all the shops and main offices where officials are likely to be taken by their duties. Each official has his own call, which may be a code rung on a bell, or a combination of three colored lights made to flash up in code form. On observing that he is called, the man goes to the nearest telephone and is switched on to the caller. A variety of loud speaking telephones or dictagraphs have also been introduced. These are particularly adapted for connecting up the chief officials of the firm, inasmuch as conversations can be held in the ordinary voice while sitting at the desk, and a number of persons can be brought into the circuit, all being in intercommunication at once. Three-cornered discussions or meetings can thus be held, the participants remaining seated at their desks, each in his own room.

**52. Writing-Telegraphs.**—When instructions are conveyed by telephone the danger of misunderstanding is constantly present, particularly where figures are in question. To obviate this, writing-telegraphs are used. One variety is the telegraphic typewriter, in which two instruments are connected by a wire, and words struck on one keyboard appear in print on a roll of paper at each end of the line. This machine does not, however, have much commercial use. Another variety, known as the telautograph, works on an entirely different principle. At each

end of the wire an instrument is placed consisting of a stylus or pen connected by short rods or levers with the electrical apparatus. As the stylus at one end of the line is moved in the act of writing, the second stylus at the other end of the wire moves in exact imitation of the first stylus. These machines are frequently used on private wires between offices and plants, between laboratories and mixing rooms, and so forth, or wherever it is necessary that the utmost accuracy in the dispatch shall be secured. As the writing is recorded at both ends of the wire in exact facsimile, the sending station can always make sure that no error has been made. Also, the written record at both ends is always there to prove the origin of any error that has been made.

**53. Carrying Documents.**—The quick transfer of papers and documents is frequently quite as important as quick verbal communication. Unfortunately all systems so far evolved for this purpose are very costly, with the result that most firms rely on a messenger service so organized as to collect and deliver hourly at each department or bureau of the business. In other words, a local postal service is organized. This is not often really satisfactory, messengers of sufficiently reliable kind not being easy to find, as the work has obviously no outlet to better positions. Mechanical transport is therefore adopted by large firms. The two principal types of such service are the pneumatic tube system and the carrier system. Of the two, the tube system is the most costly, but by far the most generally useful.

**54. Pneumatic Tubes.**—The document to be forwarded is placed in a small tubular case, and is then blown through a pipe to the receiving station. In practice, this system is not very flexible, and several complications have to be introduced to give it practical value. The most complete installations work on the principle of a telephone exchange. Each department is connected by a tube with the central exchange, where also the air pressure and suction engines are located. The carriers are then sent from one out-station and relayed at the central to another tube, thus reaching their destination.

Improvements have been made of late years, and larger carriers are possible, thus necessitating less folding of documents. Some firms have installed very large and complete pneumatic systems capable of handling all orders, drawings and blueprints, and general office papers in transit between all their departments. Incoming mail is also handled through the tubes. In smaller plants, single lines of tube can be installed between points that are a considerable distance apart and yet have much traffic between them. Such local tubes are worked by hand air compressors, and if two or three of them are centered at one end in the same office, a miniature exchange service is inaugurated. In such cases the central is not infrequently placed alongside the plant telephone switchboard, the operator being thus able to attend to both forms of intercommunication at one time.

**55. Carrier Systems.**—Within their limitations selective carrier systems are very satisfactory, but they have no great range. They consist mainly of an arrangement of continuously running cords, carrying prongs or fingers that pick up papers as they pass certain fixed points, and drop them again at other fixed points. The cash conveyors with running cords, frequently seen in department stores, will give some idea of the principle. The use of such appliances is mostly confined to offices in which papers are transferred from one man to another and from floor to floor. As these carriers run continuously and automatically, no attention is necessary beyond placing the paper to be forwarded in a special rack. When the fingers come along, they pick up the paper without any further attention from the sender. Similarly, the paper is left behind in the rack of the receiving station, and only needs to be removed at leisure. Such carriers cannot be used over long distances or taken through the open air, as between buildings, and are therefore of only limited use. A somewhat similar arrangement is the basket carrier running on wires. It will work only in a perfectly straight path, which of course must be clear of all obstruction to the passage of the basket. It may, however, be arranged to rise from one floor to another

and then set forward on a horizontal journey. It can carry considerable weights, and in this respect has the advantage over the two systems previously described. Within its limitations, which are very close, the carrier is a useful and practical method of transportation for office purposes. It can also be used in the plant for carrying orders, drawings, small tools, gauges, etc. between fixed points.

**56. Duplicating.**—The necessity for duplicating and multiplying copies of documents has given rise to a variety of appliances for the purpose. As far as the multiplication of letters and typewritten documents is concerned there are three principal methods in general use. Aside from these, there are other methods, based on the use of photography, which are employed for the copying and duplication of plans, drawings, and similar papers.

**57. Duplicating Typewriting.**—Where a limited number of copies are required in the shortest possible time, no better method is found than that of the gelatine process. A number of multigraphs of this type are on the market under different names, but they all depend on the property possessed by certain gelatine compounds of absorbing aniline ink and giving it out again under moderate pressure. Originals are written with a special ribbon on an ordinary typewriter, placed face down on the gelatine surface, and left for a short time until the ink is absorbed. Duplicating is effected by applying clean paper to the gelatine sheet, after the original has been removed, and gently smoothing under slight pressure. When taken up, the paper has received a copy of the writing that, for fifty or a hundred copies, is usually quite legible. This method is very useful for circulars of minor importance. It is not neat enough for formal communications addressed to outsiders. Another method, demanding more care in the preparation of the original, is the stencil method, in which the text is typewritten on a thin sheet of wax paper, the ribbon being removed from the machine, so that the type strike directly upon the sheet, converting it into a stencil. This is then used, with printer's ink, to prepare a large number of copies. This method gives very good results.

**58. Office Printing Devices.**—Another method of great flexibility and unlimited capacity as to the number of copies to be made, is provided by machines that print from rubber type. In these machines the original is set up in actual type, on a cylinder, by means of a special frame holding the type in convenient position. When the words are all set up, paper is stacked in the machine, the inking device is adjusted, and then a simple turning of a handle will produce as many copies, all identical, as required. In some cases such machines can be made to take curved electroplates, bearing either illustrations or matter set up in regular printer's type. In this way letter headings, blanks, and all kinds of office stationery can be printed in the office itself, as and when wanted. Such machines are exceedingly handy, and their use is rapidly extending. Even a small office can make use of them to advantage, in view of the great variety of work, from circular and form letters to actual printed forms, that they can be made to produce. Stocks of stationery may be reduced, and the awkwardness of a sudden discovery of shortage in some important blank is largely obviated by the possibility of turning out a fresh supply at short notice.

**59. Photographic Duplication.**—Aside from the regular use of photography to prepare views of machinery, buildings, and the like, or to copy tracings on blueprint paper, the use of the photostat is rapidly becoming widespread in business. This apparatus comprises a large camera fitted with continuous rolls of sensitive paper (much like the popular roll-films translated to a big scale) and provided with powerful anastigmat lenses and prisms, so that photographic positive copies on paper can be made of any document, book page, or material object, laid flat on the table of the machine. The process is very rapid and quite automatic. All the requisite operations are performed by the machine, the operator merely having to set the camera by a scale, and to turn a handle. The machine delivers the photograph, ready fixed, requiring only to be dried. Even the drying is carried out by a special rapid process in the most complete equipments.

**60. Uses of the Photo Duplicator.**—The speed and automatic character of the class of apparatus just described have opened new uses for photography in business. As the photograph can be made of any size up to about three or four feet square, it follows that full size reproductions of practically any document can be made at a moment's notice. Not only is the process much quicker and far cheaper than copying by hand, but, from the nature of the process, absolute accuracy is insured. As the machine is a camera and not merely a printing frame, it is unnecessary to go to the expense of making tracings from drawings. Copies can be made from the originals direct. All kinds of legal papers, such as leases, insurance papers, agreements, and so forth can be copied with the machine and the originals can then be sent to a safe deposit, the copies being in every respect equivalent to the originals, and in certain circumstances even their legal equivalent. Where graphic records are in use, these can be copied and copies forwarded to executives by mail. Important correspondence can be laid on the copying table and a whole series copied on one sheet, either full size or greatly reduced.

**61. Importance of Written Records.**—Many executives, in avoidance of what is termed red tape, do not place a proper valuation on having communications between departments made in the form of written memoranda instead of verbally. The use of the telephone is a tempting short cut in many instances, but it has two disadvantages. First, too much telephoning takes a man's attention away from his work, which he has perforce to leave in order to conduct a conversation. While a written memorandum can wait a convenient season for attention, a telephone call must be answered at once, however detrimental to the work in hand. Second, no record remains of a conversation; therefore, in case of error or misunderstanding, the blame cannot be fixed. Many men are quite clever in making use of misunderstandings of this kind to cover their own shortcomings. It is therefore much better that anything in the shape of an instruction, or a modification of a written order, should itself be in writing. If a proper



system of intercommunication exists this should not involve any delay. The satisfaction thus secured cannot be underestimated. Many executives also make it a rule never to give a decision on any matter verbally. The facts are put down in black and white and the reasons for the decision alongside them. These reasons need not be communicated to others, but should be filed for the executives' own use. Often it will happen that the power of referring to a decision made long ago, and finding the reason for that decision, is of great value. Although forgotten for the moment, such reasons may be found to hold good, and continuity of policy is thus maintained.

**62. Addressing Machines.**—Another useful office appliance is the addressing machine in one of its many forms. The general principle of all these is the same, but the method of preparing the printing unit differs. In a small office, or for a rapidly changing list, such as a subscription list of a periodical, the type of machine that uses stencils prepared on an ordinary typewriter is to be preferred. For more important uses, the type that uses metal plates, embossed by machinery with the names and addresses, can be employed. In either case the scope of the machine is about the same. Modern types of machine are fitted with selective devices, so that any desired section or class of the total list may be addressed, thus offering great advantages for rapid circularization of special classes of customers or prospectives. In some cases the address can be printed onto the circular letter itself, and where window envelopes are used, this completes the addressing of such circulars.

**63. Indexing Devices.**—Indexing is a very important section of business practice. The best records are useless if they cannot be referred to on the instant. This is insured by proper methods of indexing all papers, documents, and information possessed by the firm. It is not so very long since the first introduction of the card index, which was regarded as a wonderful advance over the clumsy index books formerly employed. Today, however, the ordinary form of card index is being rapidly superseded by devices that give visual control

of the information. The defect of card indexes is that the cards are hidden behind one another. To obviate this, tabs and guide cards are employed, but without getting to the core of the problem. Recently a number of devices have been introduced, some of which are used for displaying addresses and similar short information only, while others present large cards or sheets. In either case the indexing information is always in full sight. The first method makes use of little bars of card, or of paper enclosed in transparent tubes. The address or other heading (as, for instance, the names of goods in a storeroom) is written on these bars, which are then placed one above the other in a special frame or holder. The holders are hinged like the leaves of a book. The system, in fact, provides what is equivalent to a book with removable leaves, each leaf being also equivalent to a page with removable lines. The utmost flexibility and visibility are secured by this method. It is as superior to the old card system as that was to the former indexing books.

**64. Visible Records.**—The second class of visible records usually consist of a frame capable of supporting and holding a number of cards or sheets, one above another, so that an edge of each is alone visible. On this displayed edge the key or indexing information is written. Thus, if the system is applied to ledgers, the edge will display the names of the customers, or in the case of a stores ledger, the names of the articles. As new sheets can be introduced at any point, an exact alphabetical order is always maintainable, however many the changes that take place. Each set of cards or sheets thus held is itself indexed on some part of the holding frame, so that a series of such frames holding many thousand accounts permits the quickest possible identification of its contents. It is possible to drop one's finger on a particular account out of thousands without the slightest hesitation or fumbling. It will be easily understood that such devices effect an important saving of time and labor, not only as regards the regular work of entering up and posting, but especially as regards the facility for quick reference to any detail contained in the file.



**65. The Principle of Exceptions.**—In the Sections which follow it will frequently be found stated that under such and such conditions the executive need waste no further attention on a situation. By this is usually meant that the records are so arranged as to signal when attention is required. The idea underlying this method of handling business is often called the principle of exceptions. It is a method that removes a considerable burden from the shoulders of the executive, inasmuch as it often suffices that he give a mere glance at a chart to satisfy himself that a whole body of complex transactions is proceeding satisfactorily. In this way he conserves his energies to attend to essentials that really need his attention. The old-time executive was always poring over figures and burrowing into ledger accounts, simply because in no other way could he get to understand what was going on. He hardly ever did get the drift of what was going on, but by hard work he was able to assure himself that very little was being neglected. As far as possible he reviewed the details of every transaction personally. No executive could do that today, and live. The proper work of the executive is too heavy to permit it. Consequently, wherever possible, the principle of exceptions is brought into play, and records are based on that principle.

#### EXERCISES

- (1) (a) Name special advantages of photo-duplication. (b) Name some uses to which photo-duplication is particularly adapted.
- (2) (a) How can a line be made to represent a number? (b) How can a circle be made to represent the percentage division of the work of a department among the different activities carried on by that department?
- (3) (a) What equipment in calculating machines is recommended for a department doing a large amount of computing of mixed character? (b) What equipment is adapted for a department doing only straight accounting, in moderate amount?
- (4) Explain how maps may be employed to advantage in the visual control of sales operations.

- (5) Illustrate by reference to Figs. 2 and 3 how a line graph representing the results of a time study can be made to give valuable indications as to improvements to be made in an industrial operation.
- (6) (a) What is the advantage of a moving-average chart representing the output per month of a plant, over a simple graph representing directly the output for each month? (b) What is the advantage of the moving-average chart over the cumulative chart?
- (7) (a) Name three things which are commonly consumed in industrial operations and whose consumption may be controlled by suitable meters. (b) Why is it essential to have such meters installed?
- (8) A tabulating machine which sorts and rearranges statistical matter by means of punched cards has been described in the text. Where is its use particularly recommended, and where are its advantages insufficient to warrant the expense of its use?
- (9) Suggest criticisms of the card index system, and indicate some modern substitutes, explaining their advantages.
- (10) State some of the limitations of the following methods of conveying documents and other light articles within the office or plant: (a) Pneumatic tubes; (b) carrier systems.

## CHAPTER III

### THE EXECUTIVE AND THE OFFICE

#### RELATIONS WITH THE PUBLIC

1. **Function of the Office.**—The office is that part of the business organization which attends to the paper work of all transactions with the public, and particularly with customers. As the term is technically understood, it does not include any part of the factory organization, nor, as a rule, of the purchasing organization, nor is it concerned directly with the selling arm of the business. But with these exceptions it has to transact and record a mass of detailed operations with reference to all outside relations. In the first place, it receives, acknowledges, dissects, manifolds, and hands orders to the departments whose duty it is to fill them. The office corresponds, when necessary, with the customer about the orders. When they are dispatched, it bills the goods. It records the bill in ledgers, having previously considered whether the transaction is a safe one from the credit viewpoint. When the customer remits, the office receives the money, credits the customer, and sends a receipt if required. It urges payment by delinquents. It takes care of all complaints, traces lost or delayed goods, and adjusts claims. While it neither solicits the order nor makes the goods, it may be said to nurse every order to the final point where the customer is satisfied and pays his account. All this activity implies considerable organization, and it is the object of this Section to study the general requirements of a suitable and effective organization for the purpose.

2. **Office as the Business Front.**—The office is the facade of the business, which is turned toward the public. The general reputation of a concern is very much at the mercy of the office staff, whose actions determine whether business is made pleasant and easy to do, or the reverse. However excellently organized a business may be in other respects, the office atmosphere will do much to make or mar success, particularly when the scale of operations is not large, that is, in the earlier and most difficult years of business life. It is at all times easier to make a bad impression on those with whom we deal than it is to recover good standing, or to wipe out the damage done by a single inconsiderate act, and when it is remembered that the members of the office staff often handle delicate situations of many kinds, the desirability of cultivating a suave, exact, and courteous habit of dealing with matters at all times becomes manifest. Needless to say, the keynote of such a habit must be furnished by the executive himself, example in such a matter being worth more than any amount of precepts or injunctions.

3. **Points of Contact With the Public.**—There are several important points of contact between the office force and the public to each of which the foregoing remarks may be applied. First, there is physical contact, the actual reception of visitors: Next, telephone contact; third, the correspondence contact; fourth, the complaints contact; fifth, the credit-extension contact; and sixth, the bill-collecting contact.

4. **Reception of Callers.**—It is to be feared that a large number of firms fail to set a proper standard as to the way in which visitors are received—one cannot say *welcomed*. It too often happens that the caller finds himself in an office, perhaps full of people, or at any rate with several persons in full view, not one of whom makes any move or takes any heed of the stranger further than to favor him with a stare. No intentional discourtesy is signified by this behavior, but it is not calculated to put the caller at his ease or predispose him to a friendly feeling toward the firm. The explanation may be that the clerk whose duty it is to answer callers is absent, but

this does not excuse the firm, though it may the individual. In the matter of making a good impression, explanations are of little service, especially when they are not made to the person most concerned.

**5. Reception Desk and Clerk.**—The nature of the arrangements for reception will vary, naturally, according to the scale of the business, and according to the location of the office, whether in a city office building, or at a works outside the city. In all cases, however, it is well to provide a standing desk or counter, on which callers can place papers and samples, and at which the less important visitors can be interviewed. When the caller enters the office and comes up to the counter, it should be the duty of some one to ask him in a courteous manner whom he wishes to see. If the person in question is not at liberty, the caller should be so informed, and asked to take a seat. Where several persons are in view of the caller, more than one should be delegated to the duty of answering visitors, even if only to the extent of informing them that the attendant will be back in a few moments. All these are elementary matters of courtesy, but they are not infrequently neglected. In some cases there is even an impression current that brusqueness and churlish behavior are evidences of live business. Nothing can be farther from the truth. Nothing is ever lost by putting a caller at his ease. A good deal may be lost by the opposite process of treating him as if he were a negligible quantity, for whom the office is not going to disturb itself.

**6. Telephone Transactions.**—The well-known slogan, "The voice with the smile wins," is a very valuable piece of propaganda. Considering how large a number of business transactions are now carried out by aid of the telephone, it is obvious that it will pay to reduce such operations to a definite routine. Calls will either be for a definite person, or they will be from some one not familiar with the office personnel. In the former case, provision should be made for a record of the call in case of absence of the official asked for. The caller should be asked if he wishes to be rung up, and generally every

effort should be made to demonstrate that, though the caller has lost time in an unsuccessful call, the firm is desirous of doing all it can to remedy the loss. Where the call is not for a specified official, it should be referred to some one—not an office boy or girl—who has a good knowledge of the ramifications of the business, and is able to give intelligent guidance to the caller either by answering a question or by putting him in immediate touch with the right person to answer it. The man waiting at the end of the wire cannot fail to be impressed favorably with the business qualifications of the firm when his inquiry is promptly, courteously, and fully dealt with in this way.

**7. Correspondence Contact.**—Usually more care is spent on the organization of correspondence along definite lines than on the rather neglected matter of personal or telephone calls. Every one recognizes that a letter is a permanent affair, and as whatever has been stated in black and white cannot be explained away, it is necessary to prevent the wrong things from being put down in the first instance. Nevertheless, especially since the war, some very bad practice has crept into business offices, excusable when clerical help was scarce and indifferent in quality, but not justifiable now. The theory underlying correspondence is still that of personal contact, though instead of being face to face, the contact is effected through the medium of letter paper. The endeavor must be so to conduct correspondence that its limitations as a means of personal contact are reduced to a minimum; that is to say, it is necessary to study how to remedy any defects, and avoid introducing new ones, through careless procedure. The principal points for consideration are those dealing with the acknowledgment of letters, the use and abuse of form letters, and the general policy of the firm with regard to correspondence.

**8. Acknowledgment of Letters.**—One of the bad practices that have recently grown up is an almost systematic carelessness in acknowledgment of correspondence. It may frequently happen that a letter cannot be answered offhand, but it can always be acknowledged, with a promise of an early

future reply, and always should be. To fail in acknowledgment is as discourteous as to listen to a statement from a customer and then turn one's back without replying. It is, moreover, very bad business. A recent case may illustrate this. An inquiry was sent to a firm for a scientific instrument, detailing the special work that the inquirer wished to do, and asking whether the instrument in question was capable of doing it. No reply was received. The inquirer took it for granted that the firm had nothing favorable to say about their instrument, and eventually ordered elsewhere. A month later he received a long letter from the first firm, giving him the result of elaborate tests they had made to see whether their instrument would fulfil his requirements, and recommending it as exceedingly satisfactory for the purpose. Nothing, of course, could be done. The order was lost simply because the correspondence department had been too lazy to acknowledge the original letter and inform the inquirer that the matter was being investigated.

**9. Use and Abuse of Form Letters.**—In the example cited in the preceding article, not even a form letter was sent to the inquirer. Possibly the case was an unusual one and no form letter existed to cover it. This leads to the consideration of the very extensive use now made of form letters, and, one might almost say, of their extensive abuse. The particular type of form letter referred to is that made up of disjointed paragraphs kept on file and put together like a Chinese puzzle when it is desired to answer a customer's letter. The theory is that a specially good phrase should be used over and over again whenever applicable to the circumstances, and that a lesser degree of corresponding facility is necessary when the correspondent is furnished with these ready-made nuggets of fine writing. Unfortunately, the proper selection and combination of such paragraphs, if anything but a disjointed and patchy effect is sought, requires as much or more skill than the dictation of a specially written letter. Moreover, the great danger is that the selected paragraphs will not *exactly* reply to some inquiries. In such cases the inquirer is apt to receive a

reply that does not answer his thought, and as a result he is discouraged and forms a poor opinion of the firm in question.

**10. Precautions in Using Form Letters.**—It is admitted that form letters, when judiciously used, do unquestionably save much time. It is of some importance therefore to determine the conditions under which they can be used to the greatest advantage. The most satisfactory type is a single complete letter, written at one time, to cover one idea, and requiring no modification, although it may require supplementing. In a business that receives a large number of inquiries, in answer to extensive advertising, such form letters may apply to perhaps 85 per cent. of the letters received. But when anything beyond the bare demand for information is received, that is, when the inquirer displays some individualism in his inquiry, undoubtedly the safest plan is to reply personally and freely to that inquiry, instead of stringing together stock paragraphs that may not exactly apply to the case. When a system like this is adopted, all that is necessary is to arrange that all letters bearing individual aspects be referred to a special correspondent, instead of being handed to the men who make up form letter replies. Sometimes the correspondent will determine that the usual letter, preceded or followed by a special clause dealing with the special inquiry, will suffice. The main thing, however, is not the saving of correspondent's labor, but the making of an adequate, precise, and individual reply to every special point that is raised. This is particularly important where, as is sometimes the case, form letters are used in connection with customers' complaints. Great offence may easily be given by injudicious selection of form paragraphs in such instances.

**11. General Policy as to Correspondence.**—Every letter dispatched from the office is virtually a representative of the firm, and by it the firm will to some extent be judged. Many firms, therefore, make a regular study of their policy as to correspondence. This policy is summed up in a series of rules for the guidance of the office staff, and the stenographers, in particular, are trained to observe these rules. The physical



aspect of the correspondence is the first matter to be considered. The choice of letter paper and envelopes, of the type used in the heading, and color of paper and ink are all important considerations. Matters of taste are implied here, and little can be said about them in a general way. What is suitable for one class of business is wholly unsuitable for another. Generally it may be said that a conservative taste is the better, unless there are special reasons why a flamboyant style should be adopted. A striking letter head may be of advertising value in one kind of business, while in another the most severe simplicity is necessary to give confidence. Having settled on the physical medium, next in order is the question of form in the type arrangement, opening and closing phrases, punctuation, etc.

**12. Manuals of Style.**—Regulations regarding forms to be used in letters are frequently reduced to writing and embodied in what are termed manuals of style, for the use of stenographers and the office staff. Such manuals aim to fulfil two objects: the adoption of what is considered by the firm good style in the appearance of its letters; and uniformity in the appearance of letters from whatever member of the staff they may originate. The question of margins is perhaps the first to be settled. Where letters are short, wide margins give a refined effect. Next, comes the question of spacing. The individual paragraphs may be spaced solid, with double or triple the spacing between consecutive paragraphs, or the usual double spacing between lines may be used throughout. The arrangement of the customer's name and address will be in harmony with the general spacing policy. Some degree of general control may also be exercised over the style of composition. Some firms insist on short, crisp sentences. Others instruct their men in the use of longer sentences, well-balanced, and making due use of the semicolon where it is called for—a point very frequently ignored. The one aim should be to convey information with the utmost clearness and precision. Perhaps no branch of office work is so much neglected as the conveying of information in clear, unmistakable language.

Yet this is little more than a trick, at most an easily acquired art. The elimination of correspondents who use long, vague, maundering sentences should be sought by the executive, for nothing is more injurious to the effectiveness of correspondence.

**13. Complaints Contact.**—The investigation and adjustment of complaints is a function that sometimes rises to the rank of diplomacy. The official who is entrusted with this work is in no ordinary degree the representative of the executive. Just as in the legal world pardon rests finally with the President or Governor, so the complaints manager is a final court of appeal with whom rests, very often, the decision whether a valued customer shall continue in that relation or be lost to the firm. The position of complaints manager is one that requires peculiar qualifications. The incumbent must not be of too yielding a nature, or he will acquire a reputation of being easily influenced. In such a case it may happen that unscrupulous customers may study how to take advantage of him. On the other hand, he must not be inflexible. It may be necessary for him, sometimes, to take an unmerited loss, without strict regard to the justice of the case. Between these two extremes, the complaints manager has to do his work; he has every opportunity to acquire a splendid training in diplomatic finesse. With this department of complaints the executive should make it a point to maintain the closest touch, not only on account of the extreme importance of observing how cases are being decided from day to day, but also for the reason that the work of the department throws the strongest light on the efficiency of the business as a whole. How transactions in regard to complaints should be tabulated and placed before the executive at frequent intervals will be discussed later.

**14. Correspondence on Credits and Collections.**—To restrict or refuse credit is always an unpleasant and delicate task, and it certainly should not be confided to any one but a man of mature judgment and diplomatic expression. The act itself is one thing—the manner in which the decision is conveyed quite another. It does not always follow, because a man is excellently adapted to judge a prospective customer,



and to fix with great precision the danger point at which business should be restricted, that therefore he is temperamentally fitted to communicate to the customer his adverse decision. If he lacks the latter qualification, the credit man's sphere of action can be confined to making a report, leaving it to a more experienced correspondent to handle the personal contact. In regard to collections the matter is not so delicate, but even here it may be well for the executive to approve the series of dunning letters that are usually sent to delinquents. This has the further advantage that the dunning procedure is reduced to a matter of routine, until a stage is reached when stronger steps have to be taken. In such cases legal assistance is usually involved, and the matter passes out of the hands of the office altogether.

**15. Office as an Executive Instrument.**—From the foregoing articles it will be seen that the office represents an important function—it is, in fact, an instrument by which the executive maintains touch with the world outside the plant. In many ways it may be considered as peculiarly representative of executive policy. It embodies functions that are the last, usually, to be delegated to others as the business grows from small beginnings. It is the pulse of the business, indicating its condition of health. It is the medium by which the executive talks to his customers, using the tongues and pens of others for that purpose. It embodies more personal relations, and therefore more delicate relations, than any other division of the business. It is therefore the division with which the executive must maintain the closest personal contact, as far as constant scrutiny of the efficiency of its operations is concerned. In a small business where the office functions are still being discharged by the executive himself, he is sensitive to the effect produced on each of his customers by his correspondence and his decisions or his handling of complaints. When, perforce, these matters devolve on others, his interest in them, and his quick response to adverse conditions, should not be abandoned, but rather increased, since he himself is no longer at the helm, but must depend on others to steer the course he has set.

#### LAYOUT OF AN OFFICE ORGANIZATION

**16. Types of Office Organization.**—The subject of office organization has not as yet received anything like the attention that has been given to the problem of organization in the productive departments. Moreover, it is really a much more complex matter. Production deals chiefly with changes to be wrought in inert, lifeless materials, although its human aspect, the labor problem, is sometimes troublesome enough. But office transactions are nearly all of the nature of exchanges with *people*. Moreover, they are mainly directed to preserving and developing good existing relations or overcoming adverse relations. The great office problem is successful control and coordination of the expression of personality in correspondence, in interviews, in the adjustment of complaints, and the regulation of indebtedness. The problem varies, also, in proportion as the executive, or at least the higher executive officers, participate directly in office affairs, or leave them to specialized officials each dealing with some small aspect of a transaction. No satisfactory general principles of office organization have as yet emerged. All that can be done is to consider some of the leading types of organization in vogue, and, by commenting on them, to enable each person to form his own judgment as to the suitability of each type to particular cases that may arise.

**17. Influence of the Scale of Operations.**—In all organizations, the scale of operations has considerable influence on the type of layout that is possible. Just as in the control of factory operations small plants and large plants require quite different arrangements, so as to large and small offices the same principle applies. In a small business the executive will usually supervise most of the correspondence, although matters of routine, like the handling of orders, bookkeeping, and cash keeping, will be devolved on subordinates. By holding the correspondence in a close grip, the executive of the small business exercises effective control over all outside relations. He remains in direct relation with each of his customers, observes the first signs of any irritation they may display, has

first-hand knowledge of the shortcomings of his employees as evidenced in the receipt of complaints, and personally attends to the adjustment of such complaints in a way satisfactory to his own sense of what is fit in each case. In a large business, on the contrary, the executive loses all this direct touch with the intimate details of daily transactions. He must rely on others to an extent directly proportionate to the increased scale of his operations. Hence, as a business grows, a change in the type of its office organization becomes essential.

**18. Office Departmentalization.**—In almost every office there will be segregation of duties to some extent. Certain persons will attend to the cash and accounts, and others will be concerned with orders. This segregation of duties is called *departmentalization*, and each of the separate classes of work is termed a department. In large businesses, departments are subdivided into *divisions*; divisions into *sections*; and sections into *bureaus*. This terminology is by no means standardized, but in any particular business, care should be taken to apply the system adopted uniformly throughout the organization, otherwise confusion may ensue as to the relative importance and ranking of officials. The most obvious departmental classifications are: Correspondence, accounts, sales, purchases. In manufacturing plants, the last-mentioned department is usually so closely connected with the factory as to be considered a department, not of the office, but of the plant. In small concerns a partner or other executive may take care of both production and purchasing, as far as the paper work of each is concerned. Each of the prime departments includes functions that are very soon split up. Thus, accounts includes cash keeping, bookkeeping, and credits. Sales includes advertising, selling, the paper work of orders, and the tracing of lost or delayed consignments. Correspondence includes almost everything else, especially complaints and collections.

**19. Example of Small Office Type.**—The layout of an elementary type of office organization is shown in diagrammatic form in Fig. 1. The work is divided among four men, who may possibly be associated as partners or directors, or one or more

may be executives and the others subordinates. The executive or principal partner has charge of the outside relations by means of the correspondence. Thus, he attends to complaints, decides on the adjustment necessary, and communicates his decision to the aggrieved party. He also corresponds with delinquents and makes collections, using just the amount of pressure he deems necessary. As already mentioned, such an arrangement gives the executive very intimate control, and

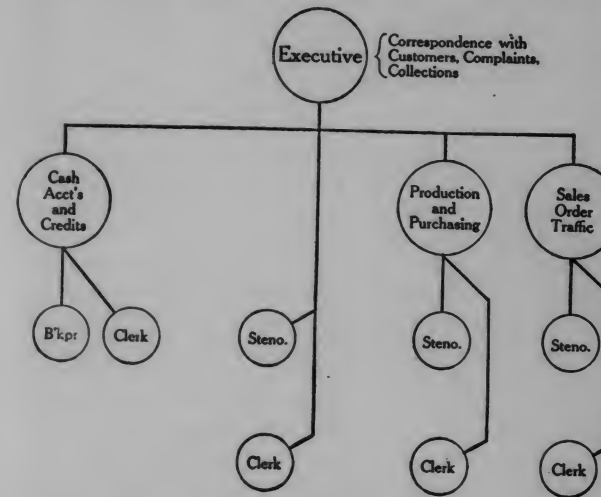
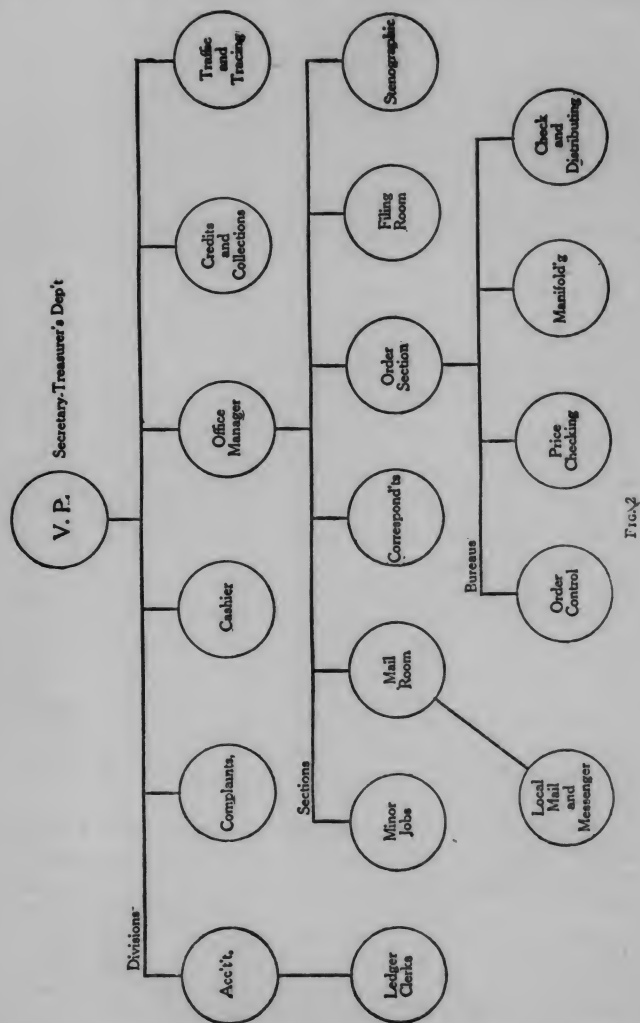


FIG. 1

very little can go on without his knowledge. The second departmentalized activity is that of accounts. This will include cash keeping, care of ledgers, billing, and issuing of statements, and will also deal with the credit rating of customers. It is probable that in such a business the accounting department will be under very close control by the executive, and will have little or no dealings with the outside except through the medium of the executive's correspondence. The sub-executive in charge of sales will attend to advertising, control of salesmen,



receipt of orders and their due despatch, and will also follow their career until delivered to customers, that is to say, he will attend to tracing consignments when necessary. The sub-executive in charge of purchasing and production may or may not have a seat in the office, but in any case his work is definite, and if subdivided, passes out of the office altogether.

**20. Example of an Expanded Organization.**—In Fig. 2 a diagram of a more advanced type of organization is shown. We may imagine that this is an expansion of the earlier type shown in Fig. 1. It will be interesting, therefore, to compare the two diagrams. In the first place, it will be noticed that the executive no longer has a place on the diagram. His function has been taken over by a vice-president or secretary-treasurer, who has charge of all office work. It will also be seen that this new office has only taken a part of the duties of the executive as shown in Fig. 1. Thus, he has no control over sales and advertising, nor over production and purchasing. On the other hand, some of the functions formerly included in sales have been taken over, namely, everything subsequent to the obtaining of the order. It must be understood that this arrangement is not in any way a standardized one. For example, it is not essential that the functions of secretary and treasurer be combined. If separated, the treasurer's function would take the accountant, cashier, and credits divisions out of the diagram without disturbance of the remainder. Therefore this and all similar diagrams may be regarded as merely a stage in the development of an office organization, and not as a fixed and final type, to be aimed at under all circumstances.

**21. Subdivisions of Expanded Layout.**—By referring again to Fig. 2, it will be seen the secretary-treasurer's department is primarily subdivided into six divisions. Of these, three are financial, namely, that of the accountant, who has charge of the ledgers; that of the cashier; and the division of credits and collections, which determines acceptance or refusal of orders and insures that they are subsequently paid for. This division might be further subdivided into two sections, one dealing with credits and the other with collections. The

other divisions have, mainly, reference to orders. Thus, first, we have the office manager, whose division embraces a number of sections, and who attends to all transactions in regard to orders, from their receipt and acknowledgment up to their despatch and billing. Next is the division of traffic and tracing, which attends to the routing of consignments by the most convenient and efficient railroad or steamship service, settles matters pertaining to the classification of freight, checks freight bills, and sends out tracers when delays on consignments are reported. This division also cooperates with the purchasing department. Finally, there is the division of complaints, which has the task of investigating all remonstrances received from customers, making replacements and allowances, and generally acting the part of peacemaker where a cog has slipped in the process of satisfying the customer.

**22. Division of Office Management.**—The divisions discussed hitherto will apply to almost any business, though some of them may be consolidated, and controlled by single individuals, instead of being divided between two. But this is merely a question of extent of devolution; no principle, or rather no opposing principles, enter into the matter. Divergence of opinions begins to show itself as soon as the question is asked: Who is to perform the delicate task of speaking in the name of the firm? Or, in other words, who is to control the correspondence? Another way of regarding the matter is to ask whether the several divisions, especially that of complaints, and that of credits and collections, are to be considered as wholly independent units, conducting their own relations with customers, or whether, in respect to correspondence, they are to enlist the assistance of the office manager and his correspondents, the latter being then wholly responsible for the form in which the views of the firm have been expressed.

**23. Responsibility for Correspondence.**—The arguments on the question of responsibility for the expression of the firm's views may be briefly considered. On the one hand, where each division is an independent unit, it is not only responsible for its own results, but, being in the closest and

most intimate touch with its own detail, it is likely to have a greater mastery over the necessary facts and figures. On the other hand, it is argued by some that such an arrangement gives rise to a departmental or bureaucratic attitude toward the customer, and that a specially trained corps of correspondents will better reflect the impartial executive atmosphere which is desirable. But against this, the advocates of the unit system reply that a correspondent cannot possibly get into as close a touch with the merits of a case as the department with which it has originated. He has to depend on information gathered from others, and is likely to get only part of the story, or to get it incorrectly. It is admitted, however, that a trained force of correspondents can establish a standardized condition wherein precision, smoothness, courtesy, and style are more likely to be developed than where each division handles its own letters. It will be gathered by the reader that no definite agreement is possible as between these two schools of thinking; in each case there is some gain, and some loss, so that the adoption of one system or the other must depend very much on local conditions, and even on personal prejudice.

**24. Training of Correspondents.**—One thing can, however, be done to obtain the advantages of both systems. Each division can retain its autonomy, and yet conduct its correspondence on lines previously determined and standardized. Moreover, while a correspondence section may be maintained, and placed under the guidance of the office manager, it is not difficult to arrange that each department shall have its own representative in the section. That is to say, that certain correspondents will be detailed to the affairs of particular divisions, and will keep in touch with the detail of those divisions, while remaining under the supervision of the office manager as to the manner in which the ideas in their letters are expressed. Of course, one of the principal advantages of segregating the correspondence function must not be overlooked. If situated in a division, their usefulness is bounded by that division. If forming part of a correspondence section, each man can be given opportunity to keep in touch with the



affairs of more than one division. Pressure of correspondence in any particular division can thus be relieved by distributing it to men not regularly employed on the affairs of that division. This is an undoubted gain. This arrangement gives a set of men trained and instructed in the art of expressing ideas on paper in a definite and standard manner, and also personally acquainted with the run of business in a special division, and to a less extent with the run of business in one or more other divisions. This is a flexible arrangement that does, perhaps, reconcile the two schools as much as anything can.

**25. Advantages of a Correspondence Section.**—As will be seen later, there are certain advantages, quite apart from the matter of responsibility, to be gained by segregating the correspondents. By so doing, it is possible to place the stenographers, the correspondents, and the filing room in close touch with one another. And as there is a great outpouring of papers from these sections, a conveyor can be installed to convey such papers to the mailing room. These are advantages not of organization layout, but of physical layout, and although the former should have precedence in all cases over the latter, still, where the arguments for and against are so close as in the present instance, the importance of saving time, space, and labor by suitable physical arrangements may be permitted to tip the balance. Nevertheless, it will be found in practice that, except in very large firms, too large to allow the individual factor to have any weight, a strong and forceful man who is in charge of a division, such as that of complaints or credits and collections, will insist on having complete control over his own correspondence, and it will be very difficult to deny him. Much must rest, as already observed, on the local conditions of the particular business.

**26. Mailing Room.**—In addition to the correspondence section, the office manager has the supervision of the mailing, filing, stenographic, and order sections. In the mail room letters are opened, and their contents are distributed to the departments and divisions concerned. Here also all letters find their way for enveloping, stamping, sealing, and mailing.

In a large business considerable routine is necessary. Arrangements must be made for sorting outgoing mail, so that several letters for the same firm are not sent in separate envelopes, thus wasting stamps; letters for foreign countries must be sorted out and care taken to provide the right postage, and to see that they are addressed according to the usage of the foreign country. Provision must be made for safeguarding stamps, so that no theft is possible. Printed envelopes or labels for the most frequent correspondents should be provided. The mailing section is also responsible for what is termed "works," "plant," or "local" mail service, which is a regular system of messengers calling at all offices at certain hours and bringing the mail matter intended for other departments into the mail room, sorting it out and then delivering it in much the same way as is done by a post office. This section may also be the headquarters for office boys or messengers.

**27. Filing Room.**—The choice of a filing system demands careful consideration as to the nature of the business and the nature of the call likely to be made on the filing room. There are many systems of filing, and each of them is good, but some are better adapted to particular businesses than others. Letters may be filed by name, in alphabetical order; by number, each customer and correspondent (outside) being allotted a serial number, which is then registered in a special index; by States and towns, that is, on a geographical, or, more correctly speaking, on a topographical plan. Other and more complex systems attempt to combine two or more of these features. Selection of a method should be dictated by this principle: the main object of filing is to be able to find papers. How this principle is best satisfied will depend very much on the nature of the data with which the task of finding is approached. Are the customers firms with fairly individual names, or is the correspondence with numberless John Smiths? Or, again, is business mainly with very large corporations, railroad companies, etc., which send in correspondence signed by a number of different departments and individuals? These three possible cases point to three different types of filing system. In the



first case the straight alphabetical method will probably give good results; in the second, the topographical, in which the filing basis is the town or city; in the third, the numerical system, in which each outside correspondent is given a file number, and an alphabetical index is made up, indicating the number belonging to each name. This allows of several names being indexed to one filing number, where letters are received from several sources in one firm. A card index should not be used; one of the displayed types of indexes is preferable.

**28. Stenographers' and Dictaphone Operators' Section.**—The segregation of the stenographers (including, of course, the typists who transcribe dictaphone records), instead of allotting them individually to departments and divisions, is a modern practice that has important advantages. This is particularly the case where their remuneration is partly based on the quality and quantity of work, since each letter is then passed by a head stenographer who measures the quantity before passing the letter on to the dictator. Further, the arrangement leads to economy, since a call for a stenographer received by the head is met by assigning any one of the staff who is at that moment disengaged. Idle time is by this means cut to a minimum, there is likely to be less delay in providing an operator, and the time of busy department men is not wasted. A special telephone or signal system should connect the desks of all officials needing stenographers with the desk of the head stenographer, so that the plant telephone system is not burdened with this very heavy traffic. It will be understood, of course, that certain department heads will still retain their own stenographers, acting also as private secretaries, wherever that course seems desirable to the executive. Convenience and not rigidity of system is the rule by which arrangements should be made.

**29. Other Sections of the Office Division.**—The office manager will usually have charge of the minor employees, such as janitors, cleaners, messengers, and so forth. The matter calls for no further comment. There remains, however,

a very important section that must be fully discussed, namely, that of orders. Inasmuch as the handling of orders is one of the most important, and also, in many cases, by far the largest single group of activities in the office, several separate articles will be devoted to its study.

#### LAYOUT OF THE ORDER ROUTINE

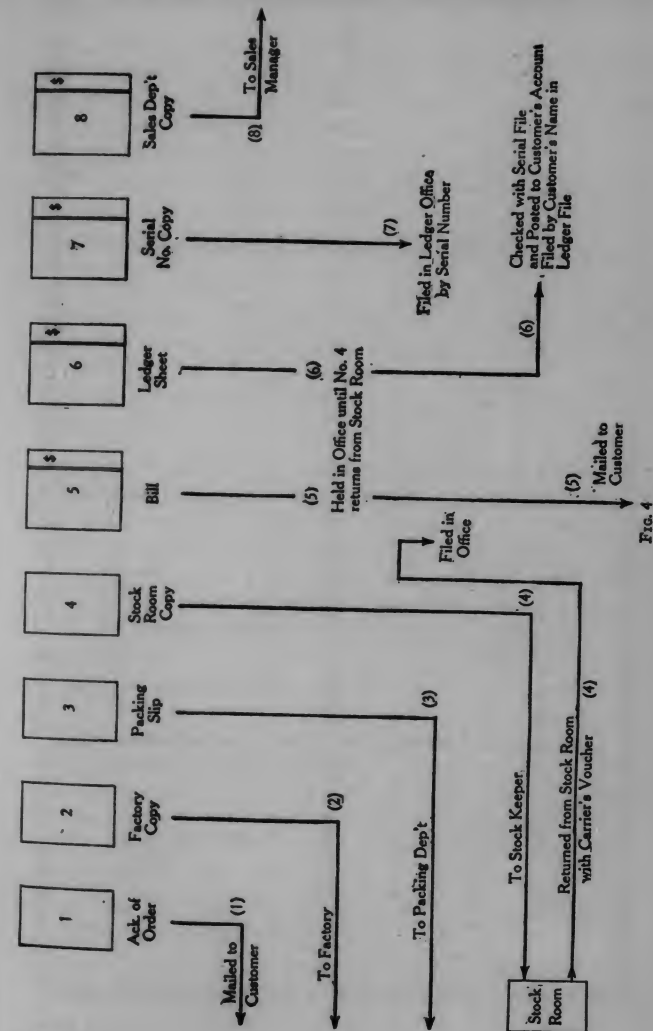
**30. General Routine of Orders.**—Since the path of orders through the office is not wholly confined within the limits of the order section as shown on Fig. 2, it will be desirable to discuss the whole subject from the beginning, so as to give in one view the relations of orders with all departments of the office. The order routine will vary very much according to the nature of the business done. The arrangements in a mail order house having a multitude of small cash orders daily would not suit a plant wherein the orders were few but of great value. Yet in both these extreme cases there are certain general principles to be observed, and as these will appear most clearly in the case of a business doing a brisk credit trade in orders of moderate size, that is the case which will be selected for illustration. On receipt of an order the following are the principal steps that must be provided for: (a) acknowledgment; (b) advice to the factory, stock room, and packing or shipping room; (c) despatch and consignment; (d) billing; (e) charging; (f) advice to sales department; (g) complaints must be investigated and adjusted; (h) the transaction must be recorded for future reference.

**31. Manifolding Records of Orders.**—In modern practice so much hinges on the multiple copying of records relating to each order, that this point demands consideration before the details of the order system are discussed. Briefly, the practice consists of making, at one time and on a special typewriter, a number of records of one order, and then distributing these in several directions to fulfil different purposes, thus avoiding much copying, entering, and posting, and the consequent liability to error. The number and nature of the manifold copies will vary according to the requirements of

<p>GENERAL MFG. CO., TROY, VA.</p> <p>5</p> <p>DATE: . . . . . TERMS: . . . . . ROUTE: . . . . .</p> <p>OUR NO. 3161 INVOICE YOUR NO. . . . .</p>	<p>GENERAL MFG. CO., TROY, VA.</p> <p>1</p> <p>ACKNOWLEDGMENT</p> <p>OUR NO. 3161 YOUR NO. . . . .</p>
<p>SALES DEPT. COPY</p> <p>8</p> <p>NO. 3161 THEIR NO. . . . .</p>	<p>STOCK ROOM COPY</p> <p>4</p> <p>NO. 3161 THEIR NO. . . . .</p>
<p>SERIAL NO. COPY</p> <p>7</p> <p>NO. 3161 THEIR NO. . . . .</p>	<p>MFG. CO., TROY, VA.</p> <p>3</p> <p>Packing Slip THEIR NO. . . . .</p>
<p>LEDGER SHEET</p> <p>6</p> <p>NO. 3161 THEIR NO. . . . .</p>	<p>FACTORY COPY</p> <p>2</p> <p>NO. 3161 THEIR NO. . . . .</p>

FIG. 3

98



99

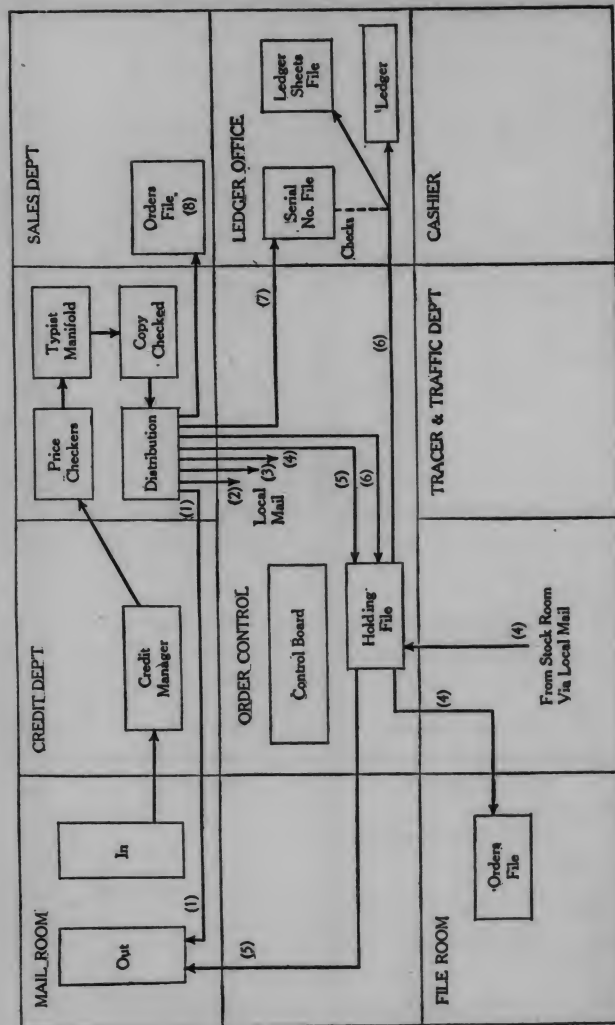


FIG. 5

the business. In the case chosen for illustration it is assumed that the routine demands eight such copies, as illustrated in Fig. 3. Although all these are manifolded at the same time and consequently bear the same information, there is one important exception. The copies in the right-hand column, Nos. 1, 2, 3, and 4, have no prices on them. This omission is arranged by the use of narrower carbons for these copies. Only the general idea is shown in the diagram; the wording on each copy will be designed according to the needs of the business. On some of the copies space for making departmental memoranda is provided, this space being either blank or differently worded on the other copies. The rectangle near the top of each form is, of course, for the insertion of the name and address of customer. Window envelopes are then used for such of the blanks as have to be mailed.

**32. Disposition of Manifold Copies.**—Fig. 4 represents the disposition of the manifold order copies. Fig. 5 shows how orders are routed. This latter figure does not in any way represent the layout of an office, but only the paths taken by the different copies. The story begins in the mail room, where incoming mail is opened and sorted. If a serial register of orders is kept, this will be a convenient point at which to enter each order received. The order is then passed to the credit department and either O.K.'d as to credit or held up for inquiry. If O.K.'d it passes to the order checking and examining clerk (or bureau) where the details of the order are examined, the price is checked and the order is O.K.'d as correct. It is then ready for manifolding. The eight copies (see Fig. 3) are made out and passed, with the original, to the checker. At this point they are carefully compared with the original and inspection is made to insure that they have been properly made out in all respects. The next step is distribution. This can be followed on Figs. 4 and 5.

**33. The destination of the different copies is as follows:**

*Copy No. 1*, an unpriced copy of the order, worded so as to form an acknowledgment and acceptance of it. This goes at once to the mailing room, and thence to the customer.

*Copy No. 2*, to the production department, when the goods, or part of them, have to be made in the plant. This copy is unpriced.

*Copy No. 3*, the packing slip, used by packer to check goods as handed to him by the stock room; an unpriced copy which is inclosed with the goods.

*Copy No. 4*, the stock room copy, forming the authority to the stock room supervisor to ship the goods. After the goods have been shipped, this copy is returned to the office, sometimes with the carrier's voucher attached, to facilitate the work of the tracing division if delay is complained of by the customer. This copy is unpriced.

*Copy No. 5*. Bill or invoice. This copy is, of course, priced.

*Copy No. 6*. Ledger sheet. This forms the authority to the accounting division for charging the customer's account and is a priced copy.

Copies Nos. 5 and 6 are held in the office until the stock room copy No. 4 is returned to the office, thus demonstrating that the goods have been shipped. No. 5 is then mailed and No. 6 handed to the accounting division.

*Copy No. 7*, serial number copy, priced. This is forwarded to the accounting division as soon as manifolding is complete. It is filed in the order of the serial numbers by that division, and thus constitutes, in effect, a day-book or sales journal. The totals of its entries at stated periods form the official total of sales, and are used in the ordinary way for accounting purposes. It is also used for checking the ledger copy No. 6 on arrival in the accounting division, and is then indorsed as having been posted to the customer's account.

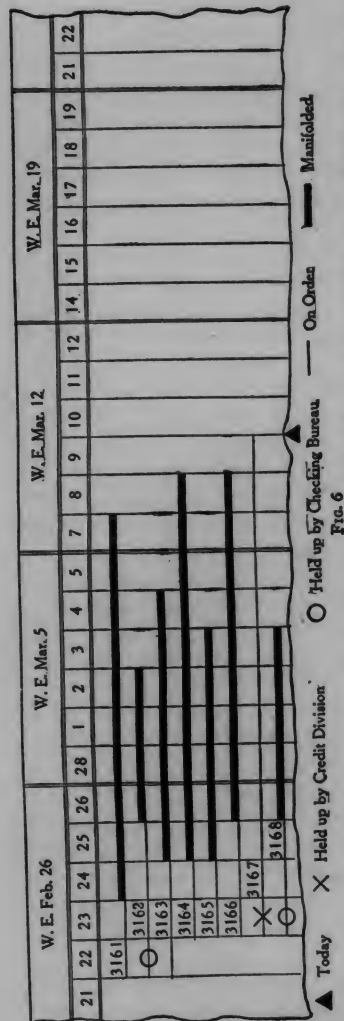
*Copy No. 8*, with prices, for the sales department.

It will be seen that the manifolding operation sets in motion a number of activities at one stroke, and provided that the copy has been carefully checked with the original, not only much time is saved, but possibilities of error in casual copying are prevented.

**34. Unacceptable Orders.**—The smooth working of the foregoing method depends upon the preliminary elimination of

all orders that, from one viewpoint or another, are not to be accepted without closer investigation. Valid orders will form at least 90 per cent. or so of the total number received. But it is necessary to consider what becomes of those that fall by the way and do not receive the O. K.'s of the credit man and the checking bureau. It is necessary to set up a routine to take care of such cases. Rejections by the checking bureau may be considered first. They will probably involve correspondence, as the refusal of O. K. will arise from some error either in description or in price. When the correspondence that ensues is terminated and the error is rectified, the order is O. K.'d with an indorsement as to reason for delay. It then enters the path of the usual routine as above described. Refusal of O. K. by the credit department is, of course, a more serious matter. The region of diplomacy is entered here. It may be policy simply to delay the acknowledgment and acceptance of the order. A higher executive may have to be consulted. Correspondence may have to be opened with the customer, but whatever step is necessary, as far as the order routine is concerned, the order has not yet qualified, and does not enter the routine. When, if at all, the credit man sees reason to raise his embargo, it will then enter the routine and go forward in the usual way. The principal point is to put orders into two distinct classes, those that are O. K. from all points of view, and those that are *not*. Then keep these latter out of the routine till the embargo is raised.

**35. Order Control Section.**—By referring again to Fig. 5 it will be seen that the point at which the bill, No. 5, and the ledger sheet, No. 6, are held in file until the stock room copy, No. 4, comes back to prove dispatch of the goods, is situated alongside what is termed a control board. This board is a device for keeping track, in visual or graphic form, of the time taken by each order to pass through the various stages of its career. The principle is exactly the same as that of the control board described in Part 2. The application to the office aspect of orders is, however, simpler than the case there described, inasmuch as only three dates have to be controlled.



The first of these is that on which the order was received, the second that on which the manifold sheets reached the control, and the third, the date when No. 4 sheet was returned from the stock room, and the bill and ledger sheets were released. The board also records the date on which O. K.'s were refused, and keeps embargoed orders in view, until they are restored to the routine. Fig. 6 gives an illustration of a control board used in this way. Modifications can be made to suit particular cases. For example, by extending a line from the received date to the due date, the board can be made to show the dates at which goods are wanted by the customer. In practice colored chalks are used, each stage being marked with a different color.

**36. Reading the Control Board.**—By referring to Fig. 6, it will be noticed that the board is divided vertically by days, six-day periods being specially distinguished. At the end of each day,

entries in the order register are transferred to the board by drawing a red line (shown thin in the figure) across that day's column, and placing the order number against it. This red line is extended each day, until receipt of the manifolds Nos. 5 and 6, when a green line is substituted for it. This green line in turn is extended day by day until No. 4 returns from the stock room. As that ends the transaction, no further entry is necessary. If the manifold does not reach the control bureau within the usual time, inquiries are made and the board marked according to which division or bureau is refusing its O. K. If the order is canceled, the control is informed, and the board marked accordingly. Today, in the figure, is assumed to be March 9. All orders on this section of the board have been completed except No. 3167, which is held up by the credit division. No instructions to cancel have yet been received. We can observe that it takes from two to three days for the order to arrive at the manifold stage after receipt. Also that an accepted order takes from four to ten days to get dispatched. If different colors are used for different classes of order, further information as to delays can be obtained. An inquiry as to any particular order can be answered at once by reference to the board, showing where the delay is, if any. It also insures that an order is not overlooked by accident, since unusual delay anywhere will give rise to inquiry by the control bureau.

**37. Summary of Order Routine.**—The principal points to be observed in relation to order routine are these: (a) The responsibility for each operation on an order should be clearly defined. (b) Operations should be so divided up as to occupy equal times, so that a uniform flow through all stages is secured; points at which delays occur should be watched; a method of control for this purpose will be described later. (c) A definite allotment of time for reaching each stage of the order routine for accepted orders, should be made. (d) Responsibility for removing an order from the routine should be centered on definite officials, who must then be responsible for insuring that the necessary further steps are taken promptly, and the order either restored to the routine or definitely canceled.



(e) The executive should make a practice of looking over the control board frequently. Though not interested in particular orders, he can read from it some interesting information as to the way in which the orders are circulating, and the delays which they are meeting. As orders are the life blood of the business, it is highly desirable to cultivate the publication habit with regard to delays. This is done by the control board, which will be treated with additional respect if it is known that the executive is in the habit of surveying it from time to time.

#### SPECIAL DIVISIONS OF OFFICE ROUTINE

**38. Complaints Division.**—A separate division for dealing with complaints will be necessary only in businesses in which a very large number of small transactions with customers take place, as, for example, in a mail order business. But in all cases, even though a separately organized division is not advisable, the responsibility for attention to complaints should be allotted quite definitely to some one official. Every letter that contains a complaint of any kind should be brought to his attention by the readers who open the mail. Attention to complaints, if not centered in a special division, should be entrusted to some one high in authority, or at any rate the final decision as to the treatment to be accorded to each complaint should be so entrusted. It is most important that a uniform policy in regard to complaints should be adopted, and this can be most effectively brought about by directing action on them from a single source. The routine of dealing with complaints will be much the same whether a separate division is set up or not.

**39. Routine of Action on Complaints.**—The successive steps which must be taken, from the time a complaint is received, until it is finally disposed of, are shown in Fig. 7. The first step is the acknowledgment of the customer's letter. This should be brief, and courteously worded. It may be a form letter. The next step is to attach to the customer's letter a copy of the order, with carriers' voucher. If there has

been previous correspondence about the order, that should also be attached. The case is then in order to be dealt with.

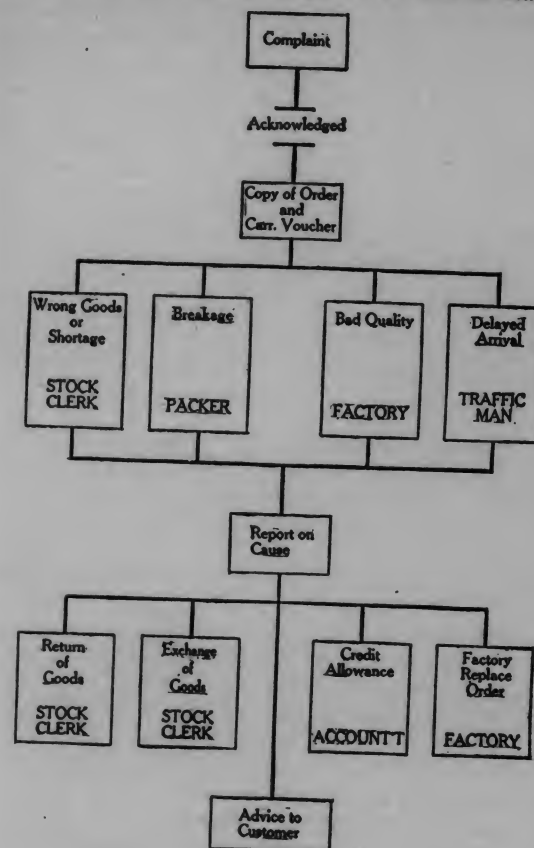


FIG. 7

In general, it will have to be taken up with one of four persons, according to the nature of the complaint, namely, the stock clerk, the packer, the factory superintendent, and the traffic

man. These are indicated in the illustration. On receipt of their report on the cause of the complaint, the matter is ready for decision. The customer is written to, stating the steps that have been taken to meet his complaint, and apologizing for the trouble to which he has been put. Then the various officials concerned are instructed, as shown by the figure. All papers are then returned to files. Particular care is necessary in dealing with complaints as to pressure that has been exercised for collection of bills. A stop-order to the collection department should be issued if there is any dispute about an account. This embargo should remain until the matter has been passed on, either for or against the customer. The various possibilities shown in the figure are not, of course, exhaustive. They serve merely to show the general routine to be observed. Other causes of complaint than those shown will be referred to other divisions and bureaus, but the general treatment will be the same.

**40. Division of Traffic and Tracing.**—In firms of any considerable size it is becoming the practice to employ a special man to handle all matters relating to freight and consignment of goods. His work embraces both incoming and outgoing freight. That is to say, he will have relations with the purchasing department, as well as with the office department. His work has two main aspects. One is concerned with the classification of outward freight. For this purpose he must have a first-hand knowledge of the general freight classifications of the Commerce Commission, and keep in touch with the rulings. He must also have a thorough knowledge of railroad routing, and in many cases, of shipping routes, foreign-trade routes, etc. Where export business is undertaken, this division will probably have two sections, one dealing with home and the other with foreign traffic. The latter section will also attend to specifications of methods of casing, packing, and so forth, for foreign shipment, and must understand the custom-house regulations of the countries with which business is done. A good traffic man will be able to save unnecessary expense for his firm by studying the lowest classi-

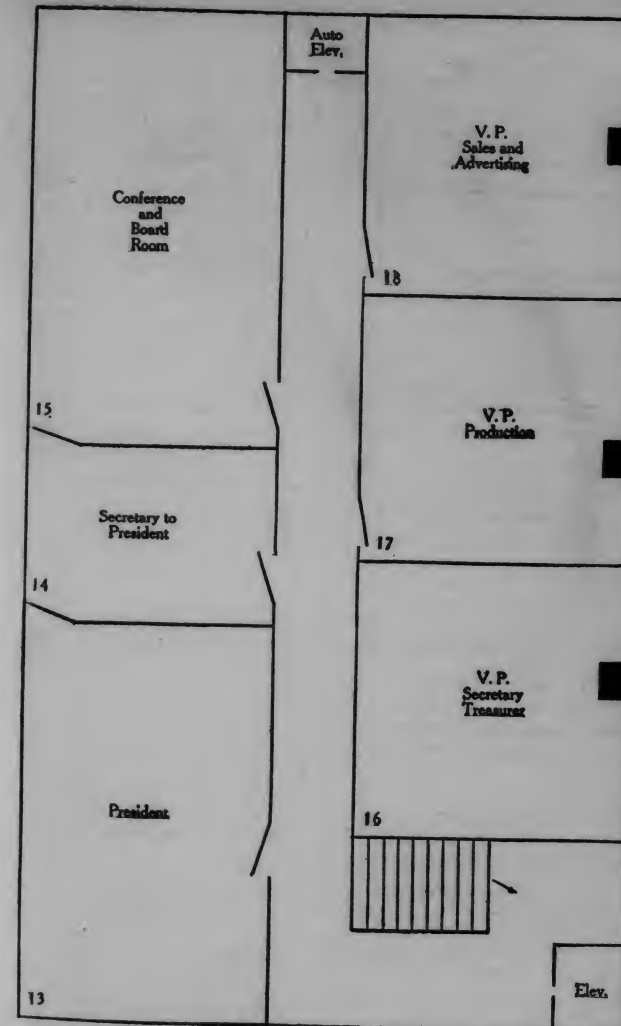
fications by which the different articles of product are consignable. Frequently a change in the form of container, or splitting up of consignments into their elements, or other devices, will permit a lower classification with a consequent saving of freight. In the course of a year this may form a notable item. The other division of the traffic man's work relates to what is known as *tracing*. Tracers are notices sent out to freight carriers, complaining of delay in the delivery of goods. When the carriers are congested, a man who "knows the ropes" will be able to afford very considerable relief, by applying his knowledge of railroad methods and getting goods moving. His relations with the division of complaints will thus be very important and close. It should be mentioned, also, that the traffic division is responsible for checking inward and outward freight bills.

#### PHYSICAL LAYOUT OF THE OFFICE

**41. Development of the Modern Office.**—In the construction of buildings industry has been a long time in breaking away from the tradition of the ordinary dwelling house. Even in the factory, this tradition lingered too long. The early type of factory, with its small windows and solid interior walls is by this time pretty universally discarded in favor of the modern shell, capable of subdivision into sections changed at will. But the office building continued to be built on the old lines, cut up into rooms, long after the shell type had been adopted for the factory. In fact this arrangement is still favored in many quarters. It was possibly the advent of the loft building that led the way to the modern office. This presents simply empty space, between four walls. All floors are alike and can be used for manufacturing, storage, or office purposes. With such freedom of arrangement, the question of utilizing the space to the best advantage acquires a special interest. Expert study of problems pertaining to office efficiency still lags behind that relating to manufacturing; nevertheless some interesting observations on the requirements of the modern office can be made.

42. **Reasons for Studying Office Layout.**—It is now recognized that surroundings make a great difference to the efficiency of work. This applies not only to the plant, but with even greater force to the office, since the latter is a place where the work is almost entirely brain work. Questions of heating, lighting, and ventilation are therefore of great importance, and deserve study when the design of a new office is in hand. These subjects, however, are outside the scope of the present work. There remain two main features of office layout for consideration here. The less important of these is the absence of noise. Modern offices use considerable machinery, and while the modern typewriter is not very noisy, the same can not be said of some other office appliances. All such distracting influences should therefore be relegated to separate rooms, constructed of sound-proof but readily movable partitioning. More important is the arrangement of the desks of different officials and clerks in such a way that persons engaged on similar work are gathered together, while communications are reduced to a system.

43. **Layout in the Small Office.**—From what has already been said on the subject of departments, divisions, and bureaus, it will be easy to understand that certain of these should be placed in juxtaposition with others, while others will have few or no interrelations, and their relative position is a matter of indifference. In a small office, where only four or five clerks are employed, the distances are so short and the whole arrangement so compact that one arrangement is about as good as another. Yet, even in this case, desks may be so arranged that a series of operations on one kind of papers, say customers' orders, may proceed in simple, regular order, the papers being passed from one desk to another in a basket. Each clerk will take from the basket behind him and pass to that in front. In proportion as the size of the office staff increases, the distances increase, and with them also the degree of specialization. Hence, haphazard arrangement no longer suffices. A plan must be adopted. The principles involved can be appreciated most easily in considering an actual case. The layout of an office organization of moderate size, consisting of some fifty or sixty persons, fully departmentalized, will therefore be described.



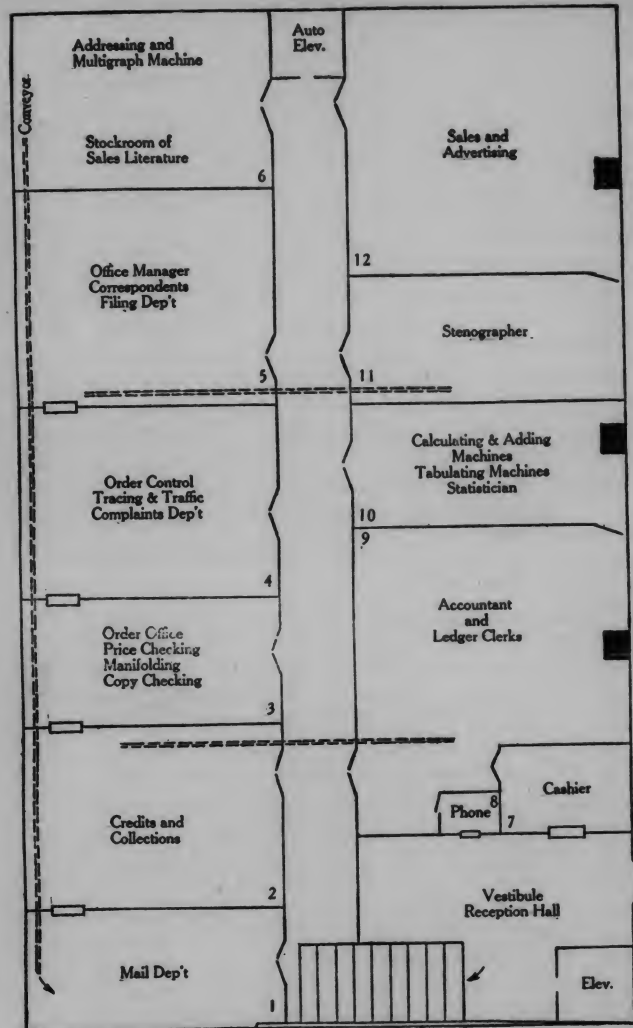


FIG. 9

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**44. Example of an Office Layout.**—In Figs. 8 and 9 an example is presented of an office layout suitable for the administration building of a manufacturing plant. The points to be observed with regard to this layout are not the actual arrangements, which will have to be modified to suit each particular business, but the manner in which the various areas are related to each other, and to the offices of the vice-presidents on the floor above. These relations will be explained in detail. Entrance through the main doors leads to a reception hall or vestibule. This may be furnished with comfortable seats so that it can be used as a waiting room, like the lobby of a hotel. The cashier's room is situated immediately on the right, with a window looking into the vestibule, at which small accounts may be paid and the numerous petty cash adjustments of a business effected without bringing the participants into the offices. Adjoining the cashier's window the telephone office is shown, also with a window looking into the vestibule, at which inquiries may be made when the regular attendant is absent.

**45. Route Followed by Orders.**—Passing now from the reception room into the office itself, there is first of all, on the left of the main corridor, the mail department, where letters are received, opened, and sorted. Orders are passed at once to the credits and collections department through the window in the partition between the departments. Correspondence for other departments is distributed by messenger in suitable containers. After being certified by the credit department, the orders are passed, through the second window, to the order office. Here prices are checked, copies are manifolded, the copying is checked, and certain copies passed through the window to the order control office. Others are distributed through the local or works mail to the departments concerned. (Compare Fig. 4 and Fig. 5.) From the order control, when an order is completed, certain copies are passed through the window looking into the filing room, while others are circulated in the local mail. In the order control office the complaints manager and the tracing and traffic man are also located.



**46. Divisions of the Ground Floor.**—On the right-hand side of the central corridor the accountant's office, the cashier's cage, and the calculating-machine room are all conveniently adjacent, and in communication. The rest of this side is occupied by the stenographers' room, and the office of the sales and advertising departments. Opposite the latter, across the corridor, is the addressing machine and duplicating room, where trade propaganda matter is made up and prepared for mail. In this room the current stock of mail advertising matter, catalogs, loose-leaf items, etc., are kept on shelves or in cabinets. Finally, opposite the stenographers' room, is that of the office manager, with the correspondents' and the filing department.

**47. Upper Floor.**—On the upper floor are located the offices of the president and his secretary or assistant, and also the room used for board meetings and conferences. Interior doors connect these three rooms. The conference room should be equipped with a stereopticon for showing charts and statistics on an enlarged scale, when several persons are assembled for conference. On the right-hand side, the offices of the secretary-treasurer, the vice-president in charge of production, and the vice-president in charge of sales are located. In the illustration only matters essential to the routine layout have been taken into account. Thus, the location of toilets, cloak rooms, etc., is not indicated, nor are architectural features other than those necessary to the understanding of the significance of the proposed arrangement.

**48. Reason for Arrangements Adopted.**—The arrangement by which the main stream of papers connected with orders is localized in the offices numbered 1 to 4 has already been explained. In office No. 4 are located the order control, the tracing and traffic man, and the complaints manager. This conjunction makes it possible for complaints regarding delay of orders to be quickly investigated, and matters requiring tracers are dealt with on the spot. As this office will be in direct telephonic or, better still, telautographic, communication with the stock room and the plant control, nearly all

matters relating to delay can be very promptly dealt with and promises made on the basis of definite information, without going outside the office. In office No. 5 the office manager and the correspondents are located, as are also the files. A circular stair to the basement gives access to ample filing space; only actually current papers need be kept in the filing room. Opposite the door of No. 5 is the stenographers' room, No. 11, thus minimizing the travel of stenographers, and yet localizing them in suitable quarters. As there will be a considerable demand on stenographers' services by the sales department, offices Nos. 11 and 12 are connected by a special door.

**49. Line of Travel of Correspondence.**—The long dotted double lines in the illustration (Fig. 9) represent conveyors for papers. One such conveyor runs through the offices from No. 6 to No. 1, delivering into the latter. By this means, letters to be mailed, originating either in the multigraph room, the correspondents' room, the tracing and traffic room, or the credits and collections room, are passed mechanically to the mail room. A similar conveyor connects the stenographers' room, at the head stenographer's desk, with the correspondents' room; a selective device passes the correspondence automatically to the particular correspondent concerned. The letters are then signed, the carbon copies handed to file clerk, and the letters are again placed on a conveyor for mailing. Another conveyor connects the accountant with the credits and collections room. Where much correspondence is carried on by the sales department, a similar selective conveyor can be used to connect the head stenographer's desk and the desks of the sales correspondents. By this type of arrangement, the use of messenger boys, and consequent liability to mistakes in delivery, is eliminated, and the traffic between the departments is greatly reduced.

**50. Communication With Upper Floor.**—It will be noted that the office of the vice-president in charge of sales and advertising is located immediately over that of the sales department; that of the vice-president in charge of production, over the calculating and statistical room; and that of the secre-



tary-treasurer, over the accountant's room. The black squares shown on both plans (Figs. 8 and 9) represent vertical paper and book conveyors, which work in both directions, thus providing for the passing of papers, documents, and books from each department to its head, with as much facility as though the latter were located in the department itself. To facilitate personal visits, a small automatic electric elevator is provided at the end of the corridor. Direct dictagraphs also connect each office on the lower floor with that of its chief above. The secretary-treasurer will also, probably, desire direct dictagraph communication with the head of the credits and collections department, and a paper conveyor also should preferably connect these two offices.

**51. General Principles of the Arrangements Adopted.**—As before mentioned, the specific arrangements shown in Figs. 8 and 9 do not necessarily fit any and every particular business, but are subject to much modification according to the nature of the business done. In particular, the relative sizes of the space allotted to departments would vary from one kind of business to another. It may be well, therefore, to call attention to the aim that has been kept in view in making the designs here presented, since it is the application of principles, and not any individual case, that is the point of interest. The following are the chief principles that have been carefully observed:

1. Departments most intimately associated have been kept together. Note Nos. 1, 2, 3, 4; 7, 9, 10; 6, 12; 5, 11; 2, 9.
2. Mechanical conveyors are used where the flow of papers is heaviest. Between Nos. 6, 5, 4, 2, and 1 a continuous flow of letters is inevitable. Note also Nos. 5, 11; 2, 9.
3. Departments in which noisy operations are carried on are segregated (Nos. 6, 10, 11).
4. While the higher officers are placed apart upstairs in close contact with one another, yet they are also in the closest touch with the departments in which they are specially interested.

**52. Provision for Expansion.**—It will be seen that there is little or no spare or waste space in the design presented.

Possibly there may be room for one or two extra employees in each department. But what is to be done as the business expands? This is a matter too often left out of consideration. An administration building, or in fact any office, should be so arranged as to provide for extension, if at all possible. In the present case it is assumed that the basement will provide space for the storage of papers and records, including vaults and strong rooms, for a long period. Access to the basement is provided by a stair descending under the main staircase, by spiral stairs in the file room and the accounting room, and by the two main elevators serving all floors. It is assumed, also, that above the floor allotted to the higher officers, a third floor has been built, for the purpose of expansion at some future date. When the time comes to occupy it, one of two plans may be adopted. Either the president and vice-presidents may move to the floor above, or a division of the offices on the ground floor may be made, some remaining on that floor, but with increased space, the others being removed to the third floor. The higher officials would thus be between the two sets of rooms, and in communication with each, as at present. All this should, of course, be planned in advance, at least in a provisional way. But it has not been thought necessary here to illustrate another plan showing such an expansion, as the principles involved will be sufficiently clear from the example given. The same principles will be applied to the extension as to the original layout.

#### EXECUTIVE CONTROL OF OFFICE TRANSACTIONS

**53. The Executive and Office Control.**—It has been pointed out on several occasions in preceding articles, that office activities are among the last to be devolved by the executive on others, in the course of the growth of a business, the reason being, that of all functions these are the most intimately connected with the personal basis on which the business has been built. The office is the expression of the personality of the executive in a way and to a greater degree than any other department. When, therefore, the business has grown to the stage at which such devolution is necessary, and when the executive has

definitely cut loose from personal contact with the detail of office business, it becomes important to set up such checks and control as will enable him, with the minimum of effort, to keep watch on the general trend of events, and to mark any deviation from normal. In some of the matters that have been treated in this Section it is possible to exercise control by statistics, expressed in chart form. Some of these will be described in the following articles. In one case, however, and that a very important one, no such statistical check is possible: The manner in which the firm's customers are being handled in respect to correspondence remains one of the most vital points of personal interest to the executive. This must be given brief consideration.

**54. Old-Time Method of Controlling Correspondence.**—In the old days, when every letter was copied in a copying press and the copy preserved in a bound book of tissue paper, it was an easy matter for the executive to run over, at intervals, the whole of the correspondence, or at least the outgoing correspondence, of any department or division. Each correspondent had his own letter book, which contained the whole history of his correspondence with the outside world. In those days many executives, even in a comparatively large business, made it a practice to run through these books at short intervals, thus keeping in close touch with what was going on. Nor did the absence of a week or two interrupt this control, since on his return the executive made it a point to go through the back pages of the books, to see what was done in his absence. With the advent of the modern system of carbon copies and individual folders for correspondence, no such simple and convenient method of control is possible, since there is now no place in which the outgoing copies are to be found collected together. That this was felt to be a drawback is shown by the fact, that for some time after the new system was introduced, many firms continued to take a press copy of each letter in the letter book, in addition to filing the carbon copy in individual folders. The copying press is now, however, an almost forgotten piece of office machinery, and

probably few clerks of the present day would know how to set about copying a letter in one.

**55. Controlling the Tone of Correspondence.** Though this simple method can no longer be applied, it remains as important as ever that (except in very large businesses) the executive should keep in as close a touch as possible with the methods of his representatives, the correspondents. While it is not practicable in most cases to make extra carbon copies of all correspondence for the use of the executive, it may be feasible to have this done at irregular intervals, by giving notice to the stenographers to take an extra copy of all letters on a particular day. This is of advantage only when a central stenographic office is established, to which all correspondence passes. It must not be supposed, however, that such a procedure is either intended or would act as a trap to catch acrimonious correspondence that had been kept from the knowledge of the executive. If such were passing through the office, the fact that it was an extra-copy day would soon circulate, and any of these letters would be held back. The object is quite different from this. It is to enable the executive to judge of the general style and tone of the correspondence. It is the unconscious revelations made by the letters, and not any particular fault, that it is important to survey. The method does not solve the problem, but it certainly will help in giving the executive a measure of insight and control that otherwise he would entirely lack.

**56. The Control of Delays.**—All systematic procedure consumes a certain amount of time. Where successive operations have to be performed on a given class of papers, it is evident that each must await its turn. On some days, also, the amount of business will be such that it will become congested at the most crowded point in its path. In popular language, every stream of papers will find a *bottle neck* at which it will tend to stick when a volume greater than ordinary is passing. The art of laying out an organization lies in arranging things so as to have as few such bottle necks as possible. This is not easy to accomplish, but an approximation to ideal





FIG. 11

papers were received. Thus, on Thursday the chart shows that the credit division was two days behind. While this may seem complex in the description, the reading of the chart can be done at a glance. It is, of course, the general trend of the situation, not particular cases, that the executive will regard. Persistent series of inclined lines against a division will imply that something needs overhauling, while occasional lines of long slope may imply that the personnel of the bureau is not able to keep up a uniform degree of efficiency. Anyhow, inquiry is indicated. Absence of inclined lines means that no attention is necessary. It should be mentioned that this chart applies only to orders actually in the routine. Orders withdrawn from the routine by denial of O. K. do not affect the chart.

**59. Observing the Order Control Board.**—The foregoing charts deal with orders in bulk, and do not apply to individual

orders, nor, as just mentioned, do they include orders withdrawn from the routine for any reason. While the executive cannot occupy himself with individual orders (unless of course they are brought before his attention specially for some good reason) he may usefully keep a general watch on the control board. As every order that has been received in the mail room is registered on this board, it will exhibit all the orders that are withdrawn from the routine, as well as those that are going through in the regular course. It will also exhibit signals indicating the division or bureau that has withheld its O. K. An examination of this board at frequent intervals puts the executive in touch with some other important facts regarding orders, namely how many exceptional cases appear among them, what principal circumstances make them exceptional, and the time taken in clearing up the difficulties that have arisen. Perhaps the executive may find it sufficient to have the used sheets of such a control board sent to him. The information will be to some extent out of date, it is true, but the general trend of events will be clear enough. Then if he does not like the looks of the situation he can turn to the current board to see whether the unsatisfactory condition still holds. A large proportion of withdrawals from routine from any cause is obviously a case for inquiry and investigation.

**60. Controlling Expense of Office Operations.**—If every transaction having relation to orders were taken away from an office exceedingly little would be left. In considering the question of the cost of office operations, therefore, it will be well to take for a basis the number of orders received in equal periods, say periods of one month. Though orders differ among themselves as to the amount of detail involved, yet by taking a sufficiently long period, it will be found that the law of average ironed out the inequalities, so that the results of one period may be fairly compared with those of another, provided that no considerable change in business policy has taken place. First, then, we take the total number of orders received in a month, and against this place the total expenditure of the office, including salaries, wages, stationery, light, heat, rent,



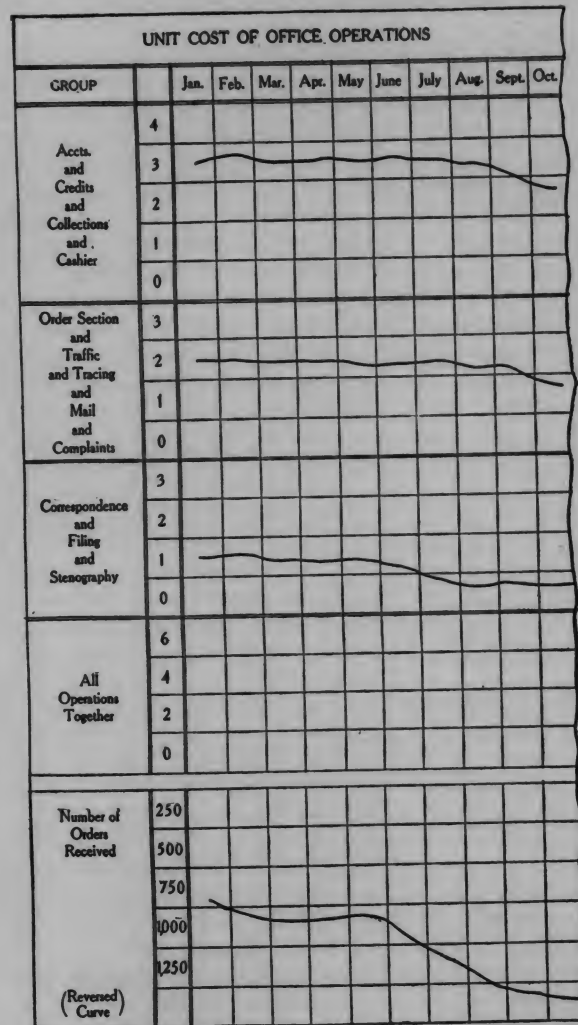


FIG. 12

124

and similar items. Dividing one by the other we have a unit cost per order for all office work. When this is first obtained it has little significance, since it is rare that any similar figures from other sources can be found with which to compare it. The detail of every business is so individual that no safe deductions could be made from such a comparison, even if the figures were forthcoming. The value of a determination of the unit cost begins to show itself when the figures for successive months over a long period have been obtained, so that they can be compared with the general conditions of business at various times and under various circumstances.

**61. Analyzing Cost of Office Operations.**—Though the estimate of unit cost referred to in the last article would be a valuable aid to lean on when making any considerable changes either in business policy or in the internal organization of the office department (enabling the executive to ascertain the bearing of such changes on the cost of transacting office business), more than this is necessary to set up a useful control of office expenditure. Changes and adjustments in office routine will be more satisfactorily carried out if the executive possesses a good knowledge of the unit cost, not only of the whole range, but also of each successive operation. The extent of refinement to which this analysis can be carried will depend upon circumstances. It can be applied so as to separate out each individual operation (compare Fig. 10) or several allied operations can be grouped and thus three or four main subdivisions of cost reduced to unit cost, until such time as a further analysis is felt to be wanted. It is best always to begin with broad classifications, because the utility of ultimate analyses is not at first perceived, but will force itself on the attention by degrees. A few facts and figures that are really made use of, are better than a larger number for which the demand has not yet fully developed.

**62. Unit Cost of Grouped Operations.**—In seeking to group operations for the purpose of ascertaining unit cost, it will be desirable to consider those which are naturally connected, and are likely to be affected in the same way by changes



in the course of business. Thus, the operations of the accountant and his ledger clerks, those of the division of credits and collections, and that of the cashier, will form one group; the work of the order section, the tracing and traffic office, the mail room, and the complaints division form another group; the correspondents, stenographers, and the filing clerks form a third. (Compare Fig. 2, the layout of the office organization.) Fig. 12 shows how the unit cost of these groups may be charted so as to exhibit graphically the changes from month to month. At the bottom of the chart is another chart in which the curve is reversed, that is, it runs downwards for increase instead of upwards, and this chart shows the number of orders received each month. The reason for drawing this curve reversed is that as business increases the unit cost should decrease, and therefore, under healthy conditions, the general trend of the reversed curve should be roughly parallel to that of the curves above it. The eye can quickly judge of this parallel relation, which would be hidden if the curve were drawn unreversed.

**63. Use of the Unit Cost Chart.**—All charts must be lived with to make them effective. It is the small change from month to month, the unexpected upward or downward turn, the strong or feeble response to the orders curve that makes the interest. A momentary glance at the newly extended curves at the end of each month conveys to the executive all he wants to know. Or at any rate it will tell him whether he should pause to inquire further. If all the curves turn in the expected direction, he simply dismisses the matter from his mind. The time when cost charts such as shown in Fig. 12 become supremely useful is when changes in office organization are being made, especially when efforts are in hand to train and improve the work of the clerks, or when payment on a piecework or bonus system is being introduced. But it will not do to wait until such changes or improvements are contemplated before commencing to gather the facts. A great deal of uncertainty as to the result of betterment efforts would be removed and such efforts would be conducted with more confidence if charts like this had been compiled for

a year or two previous to instituting innovations. In the absence of facts the executive has nothing to fall back on but conjectures and opinions. Actual charted figures, with which he is thoroughly familiar by monthly perusal, would assist him in forming judgments that are worth something. This applies not only to the present case but to the similar statistics throughout. Their compilation is often put off till it is too late for them to be of real service for comparisons when changes in organization are being made.

**64. Recording and Charting Office Practice.**—The desirability of establishing rules and standard practice for letters and other communications by means of manuals of style has already been pointed out. In the larger firms, today, many other matters are reduced to writing and embodied in manuals. The first stage is carefully to schedule the duties of each division, each section, and each bureau. The matters to be handled by each are set down with great precision. Something is said about the relations of the work of the section or bureau to that of the others, and the object of its operations is shown as clearly as possible. With regard to the work, what should be done and what should be avoided is stated. These manuals have two purposes, one being to instruct newcomers to the bureau in their duties, the other being to record the right way of doing things, to which every one concerned will be rigorously held. When compiled with deliberation and care, and worded clearly, such manuals are of the greatest possible service. The general rules of the office are also reduced to writing, sometimes with a view to presenting a picture of the office career, sometimes just as a matter of making the general regulations known to everybody. Nothing can be said against these arrangements, if properly executed and then rigidly enforced. But unless the manuals are the final court of appeal, over which no official has any jurisdiction or power to alter at his own will, they will speedily fall into contempt. Provision should therefore be made for their periodical and official revision, and no alterations of practice should be recognized until embodied in the manual concerned.

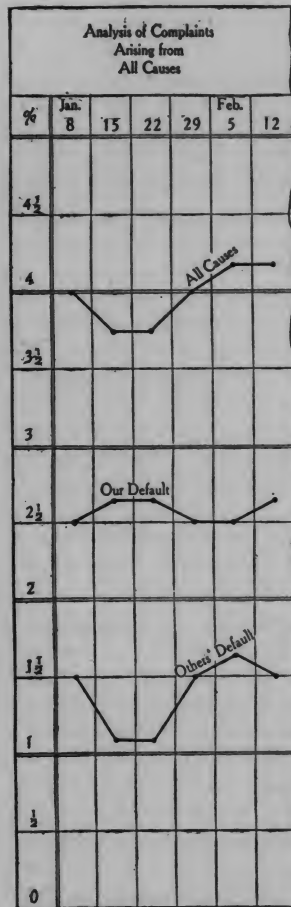


FIG. 13

**65. Executive Control of Complaint Situation.**—The desirability of the executive keeping in close touch with complaints has been mentioned in a previous article. Unless the

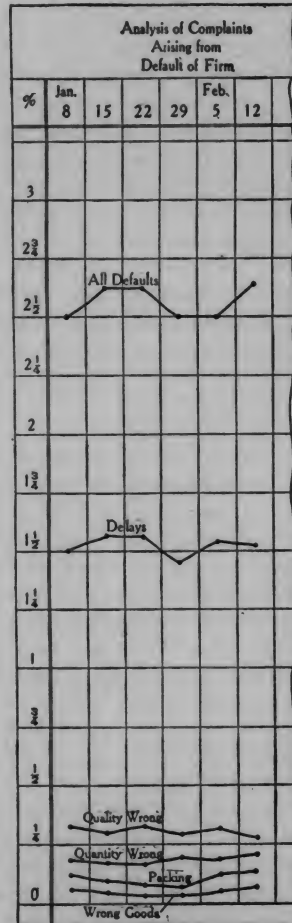
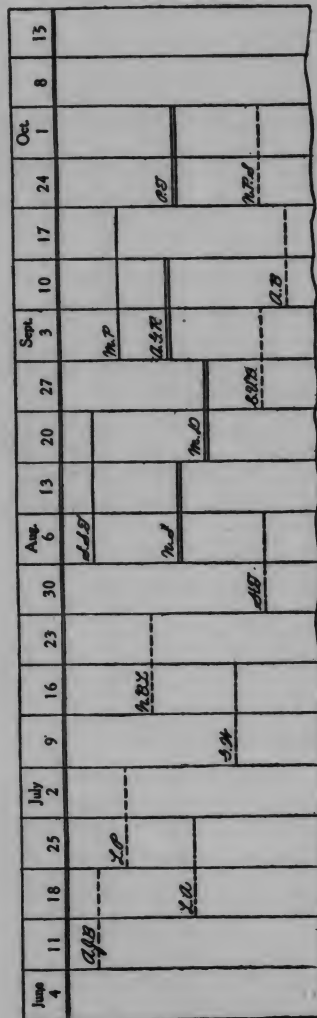


FIG. 14

case is of such importance that it is brought before his personal notice, he will not, in general, under the scheme of organization here assumed, be concerned with individual complaints. He will keep in touch with this situation, as with others, by means of charts showing general conditions and trends. It will be well to divide complaints at the outset into two main groups, first those of which the originating cause lies outside the firm, whether by the customer's own error or by default on the part of railroads, etc., and secondly, those for which some department of the firm itself is responsible. Fig. 13 shows a chart suitable for recording the first class of facts. It shows three curves, that at the top representing the percentage of complaints to the total number of orders. Below are curves showing (a) the percentage due to the firm's own errors and defaults and (b) the percentage due to the errors and defaults of others. The next illustration, Fig. 14, analyzes the middle curve of Fig. 13. At the top the second curve of Fig. 13 is repeated, as it shows the total to be analyzed. Below are curves showing the percentage of complaints due to each of several causes: delays, quality wrong, quantity wrong, etc. These curves will be of interest chiefly when read in the light of the current week's business. Like the other charts described, they must be lived with to make their full value available. Their general purpose is to enable the executive to determine at a glance whether anything demands his closer attention.

**66. Scheduling the Office Vacations.**—In a busy office the question of so arranging vacations that ample margin for service is kept intact in each department, is an important one. Though this is a task that will fall upon the divisional managers subject to the approval of the department heads, and is not strictly an executive matter, yet it is convenient to include this point here. The planning of vacations is most conveniently carried out by means of a chart like Fig. 15. Such a chart should be prepared for a whole department, that is to say, the divisional arrangements should all be included in the one chart. The chart is simple to arrange. The vertical columns represent weeks. Only that part of the year in which



vacations occur need be included. Then, by means of colored lines, one color to each section and bureau, the periods at which he or she will be absent is marked for each employe, together with his or her name. Just what vacations overlap can then be seen at a glance. The successive vacation periods in each bureau can be distinguished. Where it is necessary to transfer people from one division to another or one bureau to another to relieve employes, this can be noted on the chart. By planning these details well in advance of the vacation season, smooth running of the machine should be kept up, because the effect of each absence can be studied out at leisure.

#### REVIEW

67. The main points of office organization that are of special interest from the executive point of view have now been surveyed. The general deductions to be made from this survey are: (a) that the office is in effect the voice and pen of

the executive, in all matters except the approach to the public with sales propaganda; (b) that in the gradual expansion of a business, control of correspondence is the last matter that the executive devolves on subordinates; (c) that for this reason the interest of the executive in office procedure and his concern for its correct tone must always be very great; (d) that the layout of an office organization should delimit responsibility very exactly, and the center or headquarters for final decision on all delicate situations, such as complaints and disputed accounts, should rest with some one high in authority, whose qualifications include the tact and firmness necessary to preserve amicable relations with customers without sacrificing the interests of the firm; (e) that certain matters should be made the subject of regular graphic or visual charts and to these the executive should give periodical attention.

#### EXERCISES

- (1) In Fig. 12 the last curve is shown with its vertical scale reversed. Explain why this is done, and how it aids the eye in comparing the four curves and construing their significance.
- (2) Describe the preparation of a set of order records, indicating to what use each is put, to whom it goes, and how it is finally disposed of.
- (3) Describe briefly the routine followed in responding to a customer's complaint.
- (4) Indicate the advantages of the modern *shell* type of building for factory and office.
- (5) (a) What is meant by a *bottle neck* in the progress of papers or materials through business routine? (b) What measures should be taken to avoid such bottle necks?
- (6) Explain the advantages of segregating the stenographers of the office into a separate division.
- (7) (a) What are some of the principal duties of the traffic and tracing division? (b) Name some of the things on which an efficient traffic man must keep himself thoroughly posted and show how he can in this way secure economies.
- (8) State the fundamental principles on which office layout must be planned.
- (9) Is it desirable to separate the function of credit investigation from that of correspondence with customers whose order has been refused on the result of the credit investigation? State your reasons for or against such separation of functions.
- (10) Mention three different filing systems and indicate the particular conditions under which each system is best adapted for correspondence files.

## CHAPTER IV

### PURCHASING AND STOREKEEPING

#### THE EXECUTIVE IN HIS RELATION TO MATERIALS

**1. Material the Basis of Commerce.**—Practically all business deals in material of one kind or another. The principal exceptions are insurance companies, financial institutions (banks and trust companies), and engineering and other professional organizations which sell services and not concrete articles. Purely mercantile businesses (commission merchants) buy and sell material without doing work on it, but all manufacturing concerns deal with material in a number of successive stages. Manufacturing, being the most complex of all transactions in the course of which material is bought and sold, practically includes all other modes of commercially dealing with materials. Any person thoroughly conversant with the handling of materials in manufacture will be competent to handle them also in almost any circumstances.

**2. Raw Material.**—Manufacturing is, in general, a process by which raw material has work done upon it and is thereby converted into a new class of article, technically termed *finished stock*. But the term raw material is a very elastic one. It must not be considered to mean material in a crude state only. Pig iron or steel billets are raw material in

some industries, but screws, bolts, stampings, and castings of all kinds, angle and shaped metal, woven cloth, wire mesh, or gear-wheels may be the raw materials of others. Such material may even be quite complex articles such as electric motors, switches, and controllers, valves, clutches, and other mechanisms. The raw material of an industry is simply the material as it *first enters* that industry.

**3. Distinction Between Stores and Stock.**—For the purpose of avoiding confusion it is usual to make an arbitrary distinction between certain classes of material in its progress through the business. Material as purchased is called *stores*. Material that has passed through the factory and has been worked on, is called, when it becomes salable, *stock*. In some kinds of business there is a third classification, intermediate between stores and stock, namely, material which has been worked on but is not yet in salable form. Such material is called *part-finished product*. It enters into consideration only when parts are made in quantities and then put on one side for incorporation at some future date into salable product.

1. Stores are kept in a storeroom by a storekeeper.
  2. Stock is kept in a stock room by a stock keeper.
  3. Part-finished goods are usually treated as stores.
- Another distinction to keep in mind is:
1. Stores are purchased, and are issued to the factory for use.
  2. Stock is made by the factory, and is sold to customers.
  3. Part-finished goods are made by the factory, and held in storeroom till again wanted by factory.

**4. Scope of Current Section.**—In this Section the question of material will be dealt with only up to a certain point. The special subject for study here will be how a demand for material arises, what steps are taken to satisfy it, whence the material comes, what is done with it on arrival, and how it is issued to the production departments. Beyond the point where it leaves the possession of the storekeeper the course of material will not here be followed.



**5. Executive's Relation to Material.**—In businesses of any considerable size the executive does not come into personal relation with material at any stage. The transactions are so numerous and important that it is usual to split up the responsibility for material into several sections, each in charge of a special man. The executive must have a clear understanding of each man's sphere of action, and he must further develop a system of control by statistics and charts which will enable him to satisfy himself at any moment that affairs are in a normal condition. He must also have a grasp of the essential purpose to be served by the various activities which are set up to deal with material in its various stages. Each of these divisions has a separate efficiency of its own.

**6. Several Aspects of the Materials Situation.** There are three main aspects under which materials have to be considered. First, as regards the origin and specification of the demand; second, as regards the work of ordering and procuring what is wanted; and third, as regards taking care of material when it arrives, and holding it until needed by the factory. These three aspects represent three activities of entirely different character. It is the task of the executive so to plan that the efficiency of each of these activities is made a matter of separate responsibility, and that all concerned work together harmoniously in their common work of keeping material moving in a steady and uninterrupted stream through the plant.

The *origins* of demand are (a) the department that ascertains what special material is wanted on each order, usually called the planning department; (b) the storekeeper, who finds that certain items in his stores are falling below a fixed minimum.

*Specification* of the demand is usually made by a technical department if the article is not a standard commercial one.

*Selection* of the supply firm, and *ordering*, are the work of a purchasing agent.

*Acceptance* and care of the material on arrival is the work of the storekeeper.

## FUNCTION OF THE TECHNICAL DEPARTMENT

**7. Specification by the Technical Department.** The nature of the technical department will vary according to the business. Usually either engineering or chemical experts, or both, are involved. Specifications will contain detailed instructions to the purchasing agent and to the bidder as to what is wanted, and very frequently as to the tests which will be applied on arrival of the goods, and which the goods must pass successfully. Such specifications may deal either with material destined to become part of the finished product, and may then cover such points as composition, tensile strength, hardness, etc. of steel or iron castings, the strength and purity of dyes or drugs, the quality of leather, the weave and strength of cloth, and so forth; or they may deal with supplies, such as oils, varnishes, greases, tools, taps and dies, gauges, and similar items. Specifications will sometimes indicate special makes of articles, but as a rule are confined to specifying qualities, leaving the question of quantity, price, and firm to the judgment of the purchasing agent. Whenever possible specification of qualities and properties should be accompanied by an indication of definite tests by which the purchased article will be judged.

**8. Object of Technical Specification.**—Nearly all kinds of material may be found in very varying quality on the market. The different qualities cannot, in many cases, be distinguished by mere inspection, even by a man familiar with such material. A substance like rubber, for example, may vary from ten to eighty per cent. of the genuine article, being subject to adulteration not only with chemicals, but also with substitutes exceedingly close in chemical composition to natural rubber. In such cases a number of technical tests, both chemical and mechanical, are necessary if any particular quality of rubber is called for by manufacturing exigencies. Moreover, when simple tests for an article in general demand are well known, it is a not uncommon practice for suppliers to study how to circumvent the test. The lactometer test for milk, for



example, which should show the richness of the butter fat contained, depends on specific gravity, and can be evaded by withdrawing some of the cream and adding some loading substance that restores to the mixture the specific gravity demanded. The first object of technical specification is, therefore, to provide a mechanism for insuring that the firm is getting exactly what it wants and has paid for.

**9. Fitting the Material to the Job.**—Another function of the technical department is to consider which, among a range of grades of a given substance, is best suited for the purpose in view, due regard being given to relative costliness. Thus if a special kind of varnish is needed to fulfil certain exacting working conditions in the finished product, it is obvious that neither price nor quality *alone* can decide the selection. It is not necessarily either the best or the cheapest grade that is wanted, but the cheapest grade which will just give complete satisfaction. In such cases a compromise must be made between two extremes: using the best may mean wasting money on qualities that are of no service: using the cheapest may mean falling short of certain indispensable qualities. In practice, especially in large plants, enormous economies have resulted from the technical study of quality in supplies. Even in the case of comparatively small firms, that cannot afford to employ a chemist or other expert regularly, it is often of great advantage to arrange for consulting service in preparing specifications for the material bought in very large quantities.

#### PRINCIPLES CONTROLLING PURCHASING

**10. Purchasing and Storekeeping.**—Purchasing and storekeeping are two fundamentally different functions, one dealing with the procuring of goods and the other with their acceptance and care on arrival. In some cases these two functions are handled independently. In others the purchasing agent is considered as the head and the storekeeper as his subordinate. In large plants the former arrangement is often found, but in smaller ones, where only one good man can be

afforded, the purchasing agent takes charge of the whole routine and is responsible for the purchase, storage, and issue of all material. The two functions are not only different, but they call for different qualifications. Purchasing involves a much wider range of action and heavier responsibility than storekeeping, inasmuch as it is the branch that exercises a considerable degree of initiative, while storekeeping is capable of being reduced to mechanical routine requiring only ordinary intelligence to keep in due motion. In proportion as the material dealt in is subject to sudden or wide market fluctuations, either in price or supply available, the function of purchasing requires higher qualifications. The skill or experience required to buy steel or silk in the open market is obviously greater than that necessary to secure stocks of lead pencils or typewriter supplies. Purchasing unassisted by technical specification also requires greater shrewdness and wariness than when such assistance is obtainable.

**11. Service.**—It will be readily understood that the combined work of these two departments, purchasing and storekeeping, is a service. It exists for the purpose, of meeting, in the most exact and economical way, the needs of other departments. Its duty toward the general executive is economical purchase and as low a total investment as is possible under the circumstances. Its duty toward the productive departments is to bring forward the due quantity and quality of material asked for, at the time it is wanted. Purchasing therefore must always be ahead of demand, and the storeroom is the place where material rests between the time of its arrival and acceptance and its issue to the productive departments. Every official of the purchasing and storekeeping departments should be impressed with the idea that he exists for the rendering of prompt and efficient service, and that he will be valued by the executive in proportion as the flow of material is smooth, punctual, and uninterrupted. Each man should feel that whenever anything is wanted it is his task to provide it, or to offer the nearest substitute. It is the executive's task to try to cultivate this spirit.

**12. Routine of Purchasing-Storekeeping.**—The diagram, Fig. 1, shows graphically the relation of the various functions thus far mentioned. First the purchasing agent receives a requisition or advice that material will shortly be required. The origins of this demand will be considered later. After receiving bids (with or without specification) he issues his order. The supply firm in due course ships the goods. On arrival these are received by the storekeeper, who examines them to make certain that they are in conformity with the order. He may, or may not, be assisted in this examination by

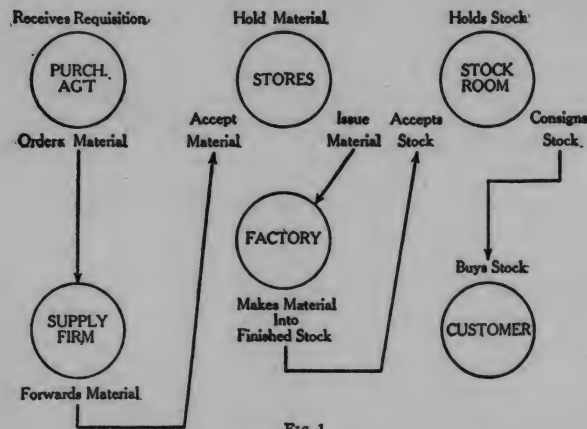


FIG. 1

the technical department. If the goods are satisfactory, he accepts them, and holds them in the storeroom until wanted. On demand he issues them in such quantities and at such times as indicated by the productive department. The productive department (called the factory in the diagram) works on them and transforms them into finished product. They are then delivered to the stock room, and on being accepted by the stock keeper are held until sold. Upon instructions received from the sales department the stock keeper consigns the goods to the customer, thus ending the cycle of operations. As will

be seen later this is only a very bald outline of what really happens, but the general aspect of the cycle should be firmly fixed in memory at this stage. The circulation of material in the factory and the stock room will be dealt with elsewhere.

**13. Necessity for Centralized Purchasing.**—The importance of having all purchasing under one hand is now generally recognized. Formerly it was a common practice for each department, and in some cases each foreman, to do their own buying, the theory being that, as each man was responsible for product, he should be allowed a free hand in choosing the material he required. In many institutions, notably in universities, municipalities, and other public undertakings, several independent purchasing authorities may yet be found. But in commercial houses, where efficiency is a factor of competitive strength, this practice is generally abandoned. The reasons for centralizing purchase are principally these: (a) the larger the quantities to be bought, the more favorably can they be purchased; (b) more detailed judgment can be brought to bear on what is really required; (c) the larger the quantities to be purchased, the better it will pay to employ technical advice as to specification; (d) purchasing is a skilled and specialized craft, and is best undertaken by a man who gives his whole time to its problems; (e) centralization of purchasing, especially when accompanied by technical specification, diminishes the chances of graft.

**14. Three Factors of Success in Purchasing.**—Purchasing is by no means an easy thing to do successfully. The picture of a purchasing agent as a man who performs his work by writing or telephoning for bids and signing his name at the foot of blanks is by no means a complete one. To attain success an agent must continually wrestle with three mutually opposing factors, and his success will depend on the manner in which he reconciles these oppositions. From the viewpoint of the general executive that purchasing department is most successfully run which:

1. Maintains the current stocks of material as low as possible.

2. Does its buying on the most favorable terms.

3. Keeps the productive departments supplied, with the minimum of delay.

It will be noticed that these three factors of successful purchasing are, in a measure, mutually opposed. It is easy to eliminate delay by accumulating large quantities of material. It is easy to shop closely as regards price, neglecting the importance of prompt delivery, or the necessity for keeping stocks low; it is also easy to keep stocks low while waiting for opportunities to buy cheaply, and while serious loss is being incurred in the productive departments for lack of material. Price reduction is not necessarily good if it involves increasing delay or quantity to be stored. Reducing quantity may be bad if it involves either higher price or increased delay. Less danger of delay may be dearly purchased if an unduly high price or too large a quantity on hand is thereby implied.

**15. Time as a Factor in Purchasing.**—It will be seen that in two out of three of the factors of success in purchasing time plays a prominent part. The objection to large stocks of material is that capital, which has to earn interest, is thereby locked up. Not only is capital locked up in the actual goods purchased but also in the storage space and the (often expensive) fittings and tackle required for storage. The whole success of business depends on rapid turnover of capital. The objection to large stocks of material is therefore an obvious one. The question of time also enters into, and is indeed the whole substance of, the third factor: the plant must not be kept waiting. In proportion as the productive departments are organized on modern lines, with exhaustive planning and scheduling of operations in advance, the imperative importance of material being on hand when wanted becomes more and more manifest. To upset the program of the shops for the sake of a small advantage in price is a grave error, causing a loss perhaps fifty times in excess of the amount economized. It is essential, therefore, that the purchasing department should never forget the principle that it exists not for itself but for others. If its peculiar professional virtue is to shop at close

price, it must never forget that the exercise of this virtue can become a vice if it leads to impairment of the efficiency of the total service rendered.

**16. Seasonal Demands for Material.**—In some classes of business the problem of purchasing is further complicated by a demand fluctuating according to season. A plant may be making one line of goods in summer for next winter's use, and another line in winter for the following summer. Frequently, though not always, these seasonal demands come very close to the period of actual consumption. An unexpected demand may then require very large output at short notice. The reverse may also happen; a bad season (from the trade viewpoint) may cause an unexpected slackening of demand. Things like straw hats, raincoats, rubber shoes, umbrellas, and so forth are obviously dependent for their demand on the weather, that is, on conditions which cannot be foreseen. Purchasing of raw material under such conditions is a matter much affected by the policy of the firm. The extent of the purchasing agent's activities will depend not so much on his own judgment, as on the instructions received from the executive, who will give such instructions after anxious consideration of all the circumstances, consultation with salesmen, and so forth. In other words, the question of purchase is ruled here not only by the market for raw materials, but by the probable condition of the selling market.

**17. Executive's Part in the Purchasing Problem.** It will have been gathered from the foregoing that the degree of complexity of the purchasing function varies not only with the size of a business, but also with its nature. It may be of a very simple character, mainly confined to filling definite requisitions for ordinary standard or staple commercial articles in specified quantity and grade. It may, again, where fluctuating material markets are involved, depend not so much on the known and visible needs of the productive departments, as on a skilful forecast of probable future needs in a rising or falling market. Large stocks of material may be contracted for when a favorable market exists, or on the other hand a falling mar-

ket may dictate hand-to-mouth purchasing even to the extent of running very close to the margin of safety as regards hindering the operations of the productive departments. In a third case, purchase of material must be controlled by considerations of probable demand for finished product in a seasonal market, and this is the greatest difficulty of all. In planning a purchasing organization the executive should therefore carefully consider how his particular business comes under one or other of these classifications, and extend or restrict the scope of the department's responsibilities accordingly.

#### ROUTINE OF PURCHASING DEPARTMENT

**18. Relations of the Purchasing Agent.**—Since the responsibility for the work of the department rests on the purchasing agent as an individual, it will be well to begin by con-

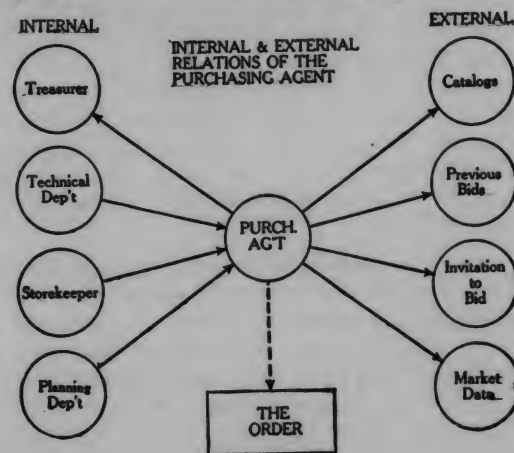


FIG. 2

sidering his internal relation to other departments and his external relation to the data on the basis of which he must form a judgment leading up to the placing of an order. In Fig. 2,

these relations are exhibited diagrammatically. At the head of internal relations those with the treasurer or other representative of the higher executive will be found indicated. As the purchasing agent is one of the largest, and sometimes much the largest disburser of money (in the shape of credit taken or incurred) of the whole organization, the necessity of close touch with the treasurer will be obvious. The necessity of consultation with the general executive in the case of seasonal demand has already been dwelt upon. With these exceptions the relations of the purchasing agent with other departments refer wholly either to a demand, or, as it is termed, a requisition, for material, or to the necessary specification of quality and grade already mentioned.

**19. Origins of Demand.**—As the function of the technical department has already been discussed, there are left to be considered the two remaining relations on the left side of the diagram, viz., storekeeper and planning department. From one or other of these two originate all the demands for the purchase of raw material. Before anything is purchased it must be discovered that something is wanted. In practice this discovery takes place either in the stores, where the stock on hand of an article is found to be below the limit prescribed; or in the planning department, where, on going over the material necessary to carry out a customer's order, it is discovered that certain material necessary is not kept in the stores. In either case a demand arises, a requisition is made out indicating exactly what is required, and the quantity necessary, and this requisition is then forwarded to the purchasing agent for his action. The way in which the prescribed limits of quantities usually kept in stores are arrived at will be dealt with in a later Section. In the case of new material requisitioned by the planning department the services of the technical department may already have been called on to furnish a specification. Or, if he deems it necessary, the purchasing agent may call on these departments for such assistance before seeking bids.

**20. Proceeding to Obtain Bids.**—With or without a technical specification, the agent has now before him all the



data necessary for his work. As indicated by the diagram, he may obtain information as to price, delivery, packing, etc., from several sources. In the case of a standard article, catalogs with their customary price and discount sheets will give him all the information necessary. Where it is a case for close competition he may refer to his files for previous bids on the same or like material, or he may decide that the importance of the matter deserves that new bids shall be invited. The final element on the chart, *market data*, refers to those materials which have a daily market price, published either in the daily press or some special trade organ.

**21. Deciding Between Bids.**—Decision as to which of several bids to accept will depend on the purchasing agent's experience of the way in which the individual firms making the bids commonly do business. Other things equal, he will assign the order to that firm which has made the lowest price. But other things may not be equal. The agent may know from previous experience that the lowest bidder is notoriously liable to fail in keeping promises of delivery. If, therefore, time is short, he will pass by such a firm. Again, if his own firm, for one reason or another, is financially embarrassed at the moment, the fact that one competitor will be more indulgent as to terms of payment, or will give longer credit, may turn the scale in his favor. Other reasons may affect the decision, and it is a delicate part of the work of the purchasing agent to balance these fine points one against another, so that his own firm obtains the maximum of advantage from the deal.

**22. The Order Not the Last Word in Purchasing.** Purchasing, as an operation, does not by any means end with the signing and mailing of an order. The object of the department is not only to purchase, but to furnish or supply. Therefore, whether an order is for a single consignment or is in the nature of a contract for periodical deliveries over a stated period, it is necessary to keep close watch on the actual despatch of the goods by the shipper at the agreed dates, to remind and press him if he is behindhand, or even, in important cases, to remind him ahead that a delivery is shortly due;

and when notification has been received that the goods are on rail, it is further necessary to observe the date at which they may be expected, and to communicate with shipping or transportation companies if they do not appear on time. In the latter case it is usual in firms of considerable size, to turn the matter over to a traffic manager whose special duty is to follow up all questions of delay, damage, rebates, and claims with transportation agencies. Whether a traffic man is concerned or not, the work and responsibility of the purchasing department do not end until the goods are actually in possession of the storekeeper.

**23. Need of Appropriate System.**—With all the varying and opposed factors in his daily work that have been mentioned the purchasing agent will not get very far or make a great success of his business if he relies on his unaided memory and intelligence as guides in making his purchases. Nor, in the case of a large plant, will he be able to give personal attention to every item passing through his department. He will need first a proper delegation of duties; second, a well-kept up system of records; third, the use of graphic methods to make visible to all concerned the condition of business passing through, and to sum up the results in quickly appreciated form for the use of the executive. In particular he will require a very exact and thorough system of control and tracing, so that the exact position of the goods asked for on each requisition may be ascertained without any turning over of records and papers but can be seen, not only by members of the purchasing agent's own staff, but by other departments concerned, at any time. The general idea of such a control will be given in some detail later.

**24. Delegation of Duties.**—The subdivision of work in the purchasing agent's office will depend very largely on the volume of transactions, and perhaps on their number rather than on their value. Where the business is principally the arrangement of long-term contracts, as, for example, in a foundry, the purchasing agent will require but little assistance, for such matters will require his own personal attention in all



details. But where a large variety of articles are being ordered daily in comparatively small parcels, the work may be divided among assistants, each of whom will handle some special line with which he is best acquainted. Thus, for example, one man will undertake all electrical purchasing, another may be an expert on small tools, gauges, and precision material, or there may be cases where a man with a chemical training or an acquaintance with the intricacies of lumber and wood makes a desirable assistant. Beyond this kind of specialization, the usual clerical specialization will be maintained. The registration of requisitions, care of files of information, correspondence, watching for delays in consignment, and so forth will each be assigned to a special clerk. The order control will also be put in charge of specially appointed men.

**25. Indexing of Information.**—It should be the care of the executive to insist that all information in possession of the purchasing department is properly and adequately indexed. The information accumulated over a term of years with regard to the purchasing operations of a business is very valuable if available. Unfortunately it is not always available. Purchasing agents are apt to rely to too great an extent on their memories. This practice is undesirable because no one's memory is infallible; furthermore, it makes no provision for the event, inevitable sooner or later, when the purchasing agent has to be replaced; his successor then has nothing to guide him, since his predecessor's unrecorded knowledge can be of no assistance to him. It must be remembered that delay of orders more often arises from the absence of some minor item of material than from exhaustion of main stocks. The only way to keep track of the sources of supply of all items is by the accumulation of records, adequately indexed. Trade catalogs and price lists, and records of all bids, successful and unsuccessful, should be indexed, so that their contents do not form an uncharted wilderness.

**26. Control of Requisitions, Orders, and Deliveries.**—The importance of the question of time in all matters relating to the purchasing and supply of material has already

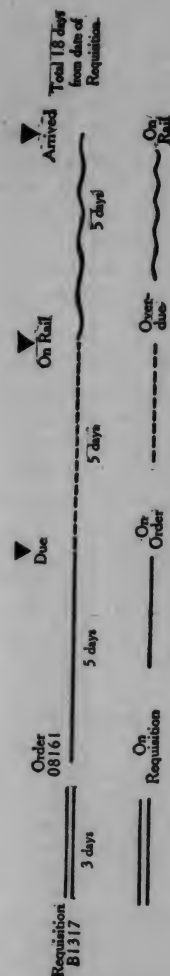


FIG. 3

been pointed out. It is advisable therefore to set up a mechanism by which the lapse of time on every requisition in its progress toward the stages of order and delivery can be seen at a glance. Such a mechanism is called a control board. Where work is divided among several assistant purchasing agents, each one should have a separate board. Where this is not the case, but the number of orders is nevertheless large, it may be well to subdivide the requisitions by classes, according to the nature of the business done. Thus, one board may be devoted to electrical purchases, another to castings and forgings, or to chemicals, oils, and varnishes, and so forth. Another arrangement, where orders are being distributed amongst several large jobbing firms, is to allot one board to each such firm. The principle of subdivision will, however, be clear, and the executive will prescribe such arrangement as is considered, after a careful review of the current requisitions, best to meet the actual circumstances.

**27. Symbolizing Order Transactions.**—The illustration, Fig. 3, shows the general principle on which the different stages of an order can be symbolized, not forgetting the time element. At the extreme left is placed the requisition number. Next, a double line extending three units to the right shows that the requisition was in the purchasing department 3 days before the order was actually issued. A single line of



of the order, though even that is valuable. It is in relation to the current or live orders at any one moment that the assistance of the board is indispensable. If properly kept up to date (and it is worse than useless if this is not done) the board has a three-fold function, (a) it answers questions; (b) it indicates steps to be taken; (c) general deductions can be drawn from it.

**30. Questions Answered by the Board.**—The control board forms a public bulletin of purchasing operations. It may be open to any one's inspection because it discloses no information as to prices or terms, while it does disclose all information as to status, expectation of delivery, and steps taken to get delivery. Where such a board is in use, officials from other departments interested in the progress of orders can visit it daily and thus observe how each matter stands. If they are not satisfied with the progress made, they can urge attention to the facts. The board answers these questions: Is the article ordered yet? When is it promised for? Is it overdue, and how much? Has it been urged forward? Is it on rail, and how long has it been on the way? If too long, has a tracer been sent out? Has any promise been received since, and for what date? Is the article now in the stores? It will be seen that this list covers almost every possible question that can be legitimately asked, and without telephoning, writing notes, or disturbing any one to get the information desired.

**31. Steps Indicated by the Board.**—To the purchasing staff itself, the control board indicates each day exactly what steps should be taken with regard to each order. If a requisition has been overlooked, the lengthening line is in itself a silent monitor. If, for example, green be the color for unfilled requisitions (instead of the double line shown in the diagrams) the purchasing agent will not like to see any prominent amount of green on his sheet. Its appearance would indicate slackness in turning requisitions into orders. A visiting executive would be apt to ask unpleasant questions. Next the position of the large black pin representing due date is

important. If one of these appears in today's column, this indicates that it is time for a reminder to be sent to the supply firm. If the dotted line from an earlier column is found to be crossing today's this suggests consideration as to whether a second reminder should not be sent. If a cross appears in today's column, it shows that a promise has not been fulfilled, and something should be done. If a wavy line is found of several days length, it calls for consideration as to the desirability of putting the traffic manager in touch with the case. In all these ways positive suggestions are made to the control man, in a way that cannot be ignored except by gross neglect. And when the control man takes the steps desired, he indicates in his turn, by means of the appropriate pin, that such steps have been taken.

**32. Deductions From Indications of the Board.** Where separate control boards are in use for the several subdivisions (of the purchasing department) the work of each assistant will speak for itself. Of course the information thus afforded needs to be read with discrimination. Some classes of articles require more time to get to the order stage than others. It might be well in some cases, where the need is felt for such a step, to divide the requisition period into two parts, say one color representing the requisitions unacted on, and the other representing the period between the invitation to bid and the order issue. The delay in the second part may be due to different reasons from that in the first part of the requisition period. The board will also give valuable information regarding the manner in which orders are being filled, promptly or otherwise, by the firms selected for business. The presence of many reminder pins on the board would show a general slackness in this respect. The executive might in such case well inquire whether preference is being given to the best source of supply; that is to say, whether time is being unduly sacrificed to price. Too large a proportion of the wavy line, or of the color selected to correspond to this, might indicate that the traffic department was not in as close a touch with the railroad authorities as desirable, or



FIG. 5

even in some cases that the question of transportation by truck might advantageously be considered by the firm. Other deductions will suggest themselves, but it must be remembered that these suggestions are very general and only open up questions for further inquiry.

**33. Loading Chart.**—Another form of control is that shown in Fig. 5. This is of limited application, but is introduced to show the resources of control methods. If there is a contract with, say, a foundry, for a definite output per week, say 900 pounds of a special grade casting, then it is a matter of importance to know how far the contract is being overloaded so as to cause delay in furnishing goods. A grooved holder is graduated on the edge so as to indicate the number of pounds on order. When an order is given out, a card is cut to a length that represents its weight on the same scale. Thus *J3161* is shown as an order for 150 pounds, *J5712* as an order for 300 pounds, etc. As shown, the orders in hand represent an overload of 50 per cent. The principal value of the device is that the cards can be shifted about and placed in any order. The total length will not be affected, but the *sequence of orders* will be. Now, if every week this chart is gone over and the orders rearranged according to the known urgency of each, and this new sequence is tabulated, a copy of the sequence can be sent to the foundry, with instructions to follow it in making deliveries. By this means a fairly close control can be

obtained, in a simple manner, over a situation that would otherwise give occasion for some confusion, telephoning, and recrimination. Other uses, within the plant itself, will suggest themselves after a little consideration.

### PRINCIPLES CONTROLLING STOREKEEPING

**34. Physical Questions Involved.**—The preceding articles have dealt with material only indirectly, in such matters as requisitions, bids, orders, control boards, and tracers. From this point on it will be necessary to consider the actual physical material, which requires not only office work, but actual handling, and demands not only attention, but occupies space. Here arises, for example, the problem of classification of material, not in the convenient form of records, over which there is ready control, but as applied to pieces of material of all sizes, shapes, and weights, some perishable, some imperishable, some of them perhaps dangerous and difficult to handle, and all of them requiring close care to prevent their getting into the wrong hands. Stores imply a storeroom, and this in turn implies careful physical arrangement, so that the articles shall be found, when needed, without delay in searching for them. Although these conditions may sound very simple and obvious, there are comparatively few plants where they are properly satisfied. Storage of raw and part-finished material is too often the weakest point in what may be otherwise a fairly well-organized plant.

**35. Essentials of Good Storekeeping.**—The ancient maxim, *a place for everything and everything in its place*, might well be posted up in every storeroom. It is the fundamental principle of storekeeping. What is more, the *place* must be easy to locate. This implies first, a logical grouping of like articles, so that, for example, pipe fittings shall be found in one region, electrical fittings in another, belting in a third, nuts and bolts in a fourth, and so on; secondly, a system of indexing every item, down to the individual sizes of such articles as wood and metal screws, so that not only shall there



be no doubt as to whether any given item is actually kept in stores, but so that the issue men may, without any loss of time whatever, go straight to the box, rack, or bin in which the size asked for is kept and produce the article wanted. These two essentials, suitable place and accurate index, form the very foundation of any system of storekeeping worth its salt. If there is anything more reprehensible in the stores than the lack of material that should be there, it is to have the goods on hand and not to be able to find them.

**36. Exactness and Foresight Necessary.**—Storekeeping is, or should be, an exact business. It is very much like keeping a cash box, with the difference that stores will stray away under conditions in which an open cash box would be perfectly safe. It also demands foresight, inasmuch as measures must be taken in time to replenish stocks that are falling low. Method must be relied on; mere unsystematic personal effort, applied to perhaps fifty thousand different articles, could not fail to result in confusion. As regards exactness, there are two main principles to observe: First, the storekeeper must be the actual recipient of all articles included in his care, immediately they are brought to the plant; second, no one must be able to get anything out of stores without his knowledge and a written memorandum of the transaction. These conditions, though so elementary, are in practice sometimes very difficult indeed to enforce. As regards foresight, a system of recording all receipts and issues of stores, coupled with a fixed limit, below which stocks must not be allowed to fall, for each class of article, makes the matter of foresight a purely mechanical one.

**37. Influence of the Executive's Attitude.**—In practice, the most carefully laid plans will not suffice to secure exactness in storekeeping, unless the situation is supported in the proper manner by the executive. There is nearly always more or less friction between the people who want the material and the people who keep it. The former have in general a more or less pronounced resentment against a system which prevents them from helping themselves, particularly in the case

of men working on repairs and similar work outside the regular line of processes. This often extends not only to the men themselves, but is shared by the foremen. The excuse of urgency is put forward as a reason why access to the store-room should be allowed, under certain circumstances, on the part of persons who have no interest in storekeeping methods. Once permitted, such a practice will soon make accurate storekeeping impossible. Records will be found unreliable, articles supposed to be in stores will be found absent, material will be mixed up, things will be put back, if put back at all, in the wrong places. If it is felt that the executive will look indulgently on the excuse of urgency for practices of this kind, storekeeping as an exact business is at an end. In such cases the general efficiency of the whole plant is bound to suffer greatly, even though not visibly on the surface. The executive's opportunity in the matter is therefore an important one.

**38. Centralized Storekeeping.**—In a former article some of the reasons for centralizing purchasing in one office were considered. It is equally desirable to place the control of all stores under one head, with certain well-defined exceptions. If stores of similar character are not centralized under one control and recorded in the same set of records, it will not infrequently happen that a deficiency in one place is accompanied by a surplus in another. This will give rise, necessarily, to a condition of running to and fro, telephoning, questioning, and confusion, because wanted articles will have to be sought in more places than one. With proper records, on the other hand, the exact quantity on hand can be ascertained at once, so that every one has confidence in the figures. There are, however, some exceptions to this rule. Where stores are of a special character, they may be in separate charge. Stationery is an example of this class of special stores. Fuel is another. Some special raw material, say leather, may be placed in charge of a special leather storekeeper. In all such cases the principle is the same. If the special stores are homogeneous in character, and if each kind



of material is all kept in one place, there is no inefficiency in placing them where they will be most convenient, under a control independent of that of the main storekeeper. No confusion can arise, because the stationery stores will carry all stationery; the leather stores, all leather; the coal stores, all coal, etc.

**39. Part-Finished Product.**—In some manufacturing businesses an important role is played by what is commonly termed part-finished product. In making machines in large quantities, such as typewriters, sewing machines, electrical apparatus, and so forth, it frequently happens that, for economical manufacture, many of the parts must be put through in large batches. It may also happen that certain subsidiary mechanisms may be built up from these parts in considerable numbers, long before they are required for actual orders. The procedure in both cases is the same. The parts are delivered to the storekeeper, and treated by him just as if they had been purchased from outside. When it is desired to make up a batch of the small assembled mechanisms just spoken of, the parts are drawn out of stores, along with other regular stores, such as nuts, bolts, screws, and when assembled, the completed mechanisms are turned back into stores and treated, again, as if they were materials purchased from outside. The connecting theory in these cases is that such parts and mechanisms have in effect been made by the firm for itself. Instead of being purchased they have been made. There is no other distinguishing feature about them. It may even happen that certain articles may be made in the plant at one time and purchased from outside at another. The advisability of treating all such things on the same footing as purchased stores will therefore be clear.

**40. Limits for Stores.**—It has already been mentioned that the foresight necessary to prevent unexpected shortage of items is secured by method, and that this method is based on a system of fixed limits for the quantities of each item\*

\*A stores "item" is one size of one kind of article. It does not refer to individual pieces. Thus "3"X4" wood screws, brass, flat head" is one item, whether a single packet or 100 gross are carried in stock.

that should be held in stores. The fixing of such limits, where the practice is to be introduced for the first time, is not an easy matter. There are two opposing factors to be considered. The desirability of having a sufficient margin or surplus, is balanced by the desirability of keeping down the investment so locked up. In the case of the more costly materials, such as brass, copper, etc., this is an important consideration. But even the cheapest materials mount up in value rapidly when the individual classes run into many thousands. Certain controlling principles can, however, be applied. Slow-moving items, i. e., those that are not often asked for, should be kept low. Standard commercial articles that can be quickly obtained in the market may also be kept low in quantity. On the other hand, rapidly moving articles, items that are specially made for the firm, imported articles, and all items for which a quick market supply may not be depended upon should be kept in larger quantities.

**41. Reviewing the Materials Situation.**—All items, class by class, should be passed in review and a tentative limit fixed below which the store is not allowed to fall. In each class, sizes and varieties will also have to be considered. Limits should be fixed not only for the minimum of stocks to be held, but also for the maximum. By doing this, the quantity to be ordered on each occasion is automatically indicated. Once these two limits are fixed, the whole routine becomes mechanical, depending on simple bookkeeping to reveal the necessity for fresh ordering, and upon prompt observation and report of such necessity when making entries in the records. Periodical review of the materials situation is also advisable. Conditions of business vary, lines of product alter, new articles come in and supersede the older ones. Consequently limits fixed today may not apply a year hence. Items that have not moved for a prolonged period should be noted, and inquiry made whether it is not possible to reduce the limit on such.

**42. Obsolete Stores.**—It may sometimes happen that inquiry will lead to the discovery an item is no longer wanted,

owing to changes in pattern or other sufficient cause. In such cases steps should be taken to sell out the remaining stock, remove the name from the records, and employ the space hitherto allotted to the item in a more useful way. Where a review of this kind is held for the first time, an extraordinary quantity of obsolete material is not infrequently revealed, and its removal is attended with considerable benefit from every point of view.

#### THE LAYOUT AND ARRANGEMENT OF STORES

**43. Enclosure of Storage Space.**—A storeroom is like a bank. It is a place of deposit for valuable articles entrusted to its protection. There are three good reasons why storerooms should be enclosed spaces under lock and key: First, for safety against theft, a danger which is in proportion to the intrinsic value of the articles and their portability; second, for safety against unauthorized withdrawals, whether for legitimate purposes or to cover spoilage of good material which it is desired to cover up; third, to avoid errors in inventory, with regard to the amount of each item actually in hand. It does not follow that a storeroom is actually a covered and walled space. It may include a shed-area, or even open ground, fenced in. Many articles require no more than a roof over them, at most, and many others may be stored in the open air without detriment. In such cases the use of an expensive building would be inadvisable. It will suffice if the area devoted to storekeeping is adequately fenced so that access to it is impossible without knowledge of the stores officials.

**44. Physical Arrangement of Stores.**—Stores are very diverse, both in size and substance. Without going into the question of particular industries and their needs in this respect, it may be stated that even ordinary mechanical stores vary in size from tiny screws or rivets up to ponderous castings. Containers of every kind have to be considered. Material will be handled in boxes, sacks, bales, kegs, drums, rolls, coils, and rod form. Some things will customarily be removed from the containers as received, and placed in permanent

receptacles, others will be ladled out of kegs or barrels as required, still others will be issued from stores to the productive departments in the original unbroken packages. It will be evident from these considerations that the problem of a layout at once convenient and economical of space is no simple one. What is satisfactory for one plant may not suit even a similar plant. What is efficient today may grow unsuitable in a year or two. Under such conditions, precise rules cannot be laid down. The best we can do is to try to find some general principles on the subject of layout that each executive can apply to his own particular case.

**45. Some Principles With Regard to Layout.**—The principle of grouping together like kinds of stores has already been mentioned. In each class it is likely that there may be

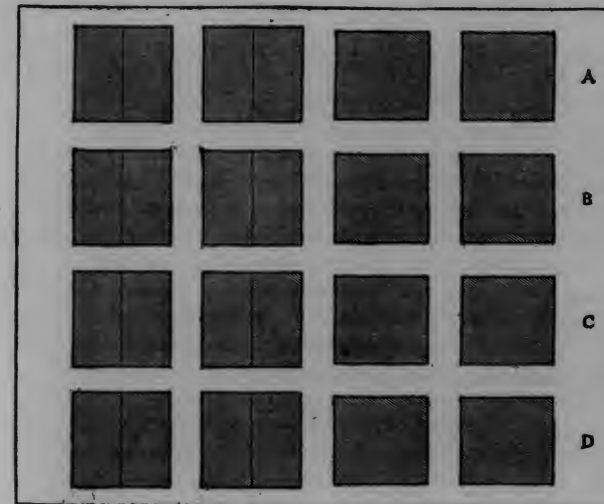


FIG. 6

numerous items of quite small dimensions, capable of being kept in bins, racks, or drawers, while others will be either quite bulky or else kept in the original containers, such as

barrels or kegs. This suggests a second principle, namely, that of having one side of the storeroom devoted to compact storage of small articles in built-up fittings, and the other side left as open floor, or with rough portable racks where necessary, to take bulky stuff and materials kept in barrels, etc. Fig. 6 shows, diagrammatically, this arrangement. The horizontal rows, *A*, *B*, etc., represent space allotted to different classes of goods, say, electrical in *A*, pipes and pipe fittings in *B*, nuts, bolts, rivets, and screws of all kinds in *C*, and so forth. On the right half the shaded squares represent open areas with portable racks when required to hold long, heavy, or bulky material and that kept in containers. Wide alleyways are kept round this portion of the stores. The left-hand portion shows stacks of bins, and drawers, containing the smaller articles. The alleyways here need not be so wide. In this arrangement the two conditions, the keeping of similar articles together, and the segregation of small articles with small, and large articles with large, are reconciled. The reason for the difference in size of alleyway will be seen later.

**46. Principles Regarding Fittings and Equipment.**—One cardinal principle with regard to storeroom fittings may be given concisely: the nearer such equipment is to the idea of the expanding (sectional) bookcase so largely advertised, the better. It must be remembered that in the arrangement of stores nothing is final. There is no *best* arrangement that can be regarded as permanent. The reasons for this have already been given. Consequently, the more facilities we have for rearrangement—which means, in practice, for moving things around—the more likely is it that rearrangements will be made when they become desirable. Whether fittings, that is, shelves, bins, nests of drawers, racks, etc., are made of wood, or, as is now becoming the practice, of metal, the adoption of built-up sections should be insisted on by the executive. There will be, of necessity, several sizes of drawers, but all those of the same size should be interchangeable. Drawers, shelving, and bins should be in multiple or sub-multiple of any other size. This principle is followed, for

example, in the catalog of unit office furniture; drawers and receptacles of all shapes and sizes are furnished, but they all fit the same main framework. This is the ideal system for storekeeping, as far as it can be applied.

**47. Locating, Indexing, and Finding Stores.**—In a large plant the number of separate items kept in stores may run into scores of thousands. Even in a small one they may run into many thousand. Yet with adequate and even comparatively simple arrangements, the finding and control of each of these items presents no great difficulty. In the absence of such arrangements the whole stores question remains in a fog of confusion. It is easy to understand that every separate article should be known by a number, but the method by which this number may serve as a complete key to location, and also to control, needs to be explained in some detail.

**48. Stores Reference Numbers.**—Every item should be allotted a number. Upon the way in which these numbers are allotted a good deal of the success of the indexing and finding system will depend. Each number must suggest, in the first place, locality, and next, the individual article. It may go further than this, by suggesting not only the general region in which to look, but also indicating with considerable precision the particular part of such region. In adopting a system of numbering, complex groups of numbers and letters should be avoided. The simplicity of a telephone numbering system, in which hundreds of thousands of subscribers are instantly identified by three elements, the city, the exchange, and the individual number, should be kept in mind. The numbering of automobiles is equally simple. Thus *N. Y. 756-987* is a simple grouping that will identify the owner of a particular machine out of millions of such owners. Just as the *N. Y.* on the machine indicates locality, so, in stores reference numbers, it is well to lay out the area of the storage space into sections or regions, exactly as the United States is divided into states, and to affix a letter or letters to each of these regions, just as *N. Y.*, *Md.*, *Ky.*, etc., indicate particular regions of the United States.

**49. Division of Storage Space Into Regions.**—Now if the method of designation of regions and their subdivisions by letters and numbers is combined with the physical arrangement of stores previously described, it is evident that a code can be worked out in which the letters indicate not only classes of goods, such as pipe fittings, etc., but at the same time the region in which they may be found. Fig. 7 shows the general idea of the allotment of regions. The storage-space plan is first divided into convenient horizontal divisions, and each

AA	AD	AF	AH	AJ	AL	AM	AN		
BA		BC		BF		BK	BL	BO	BS
CA	CB	CD	CF		CH	CJ	CL	CH	CO
DA	DB	DD	DF		DH	DL	DN	DP	DS
EA		ED		EH					
FA		FC	FF						

FIG. 7

of these divisions is earmarked for a different class of stores. Each horizontal division is then marked off in lengths, the divisions corresponding to the sizes of racks, cases of drawers, and open spaces as arranged therein. To each such length a different combination of letters is assigned (*AA*, *AB*, *AZ*). When this is done we have a plan for general classification. All the *A* row, for example, may be allotted to electrical goods. All the *B* row may be pipes and pipe fittings, and so forth. Then as to the cross divisions, *AA* may be switches,

*AF* cut-outs, *AM* motors, etc. Now, if each article bears a serial number, a two-wire, type 4 cartridge fuse, 250-volt, 200-ampere 1½-inch cut-out will, for example, be designated as *AF3231*. When asked for this number, the issue man will know at once that electrical goods, sub-class cut-outs, are in question, and further, he will know exactly where to walk to in order to lay his hand on the item wanted. But the number may give him more precise information even than this.

**50. Numbering of Tiers.**—Every vertical layer or tier of receptacles may very easily have its own series of numbers allotted to it. Fig. 8 shows how this may be done. This

REGION AF									
6000 Tier									
5000 Tier									
4000 Tier									
3000 Tier	3071	3073	3081	3186	3198	3231			
2000 Tier	2011	2019	2033	2038	2042				
1000 Tier	1012	1023	1041	1056					

FIG. 8

represents, say, region *AF*, consisting of open bins in the lower portion and nests of drawers in the upper. Each layer or tier begins with a new thousand, 1000 for the lowest tier and 6000 for the highest. Now the cut-out mentioned in the last article, being numbered *AF3231*, will obviously be found on the third tier. Thus the very simple code described indicates, first, the class of material; second, the general region



in the stores; third, the kind of article; fourth, the actual region; fifth, the individual article; and sixth, the tier in which it will be found. In a later article will be described how the store reference number is used in a *finding index*, not only for the use of the issue men, but also for the use of those persons in the plant and planning departments who have occasion to requisition for stores for issue to the productive departments, and how that number is employed for indexing the ledger cards which control the quantity of material of each kind held, in accordance with limits.

**51. Construction of Stores Codes.**—In making up codes the letters *I* and *U* are omitted, as liable to be confused with other letters. This leaves twenty-four letters. If to the alphabet so pruned we attach four figures, viz., those between 1000 and 9999, so that the combination reads, for example, *K8769*, we have close on two hundred and twenty thousand combinations at our disposal. Since plenty of vacant numbers and letters should be left when making up a code, to allow for the intercalation of new sizes and kinds of material, this would only serve a comparatively small stores organization. With two letters, however, such as *AK5487*, the number of combinations between *AA1000* and *ZZ9999* is over five million, a series large enough to cover the requirements of all but the most extensive concerns. Where it is thought necessary to do so, a three-letter combination may be employed. This will run from *AAA1000* to *ZZZ9999*, and contains the enormous number of about one hundred and twenty-five million combinations, an inexhaustible quarry for all practical purposes. For general purposes the two-letter code, arranged by regions and tiers as indicated above, will be found the most convenient.

**52. Accessibility of Stores.**—In laying out storage space, due consideration should be given to the manner in which material is to be conveyed to and taken from store receptacles. This is a very big subject and can only be glanced at here. Much will, of course, depend on the physical characteristics of the material. The handling of small and

light articles is not much of a problem, but when heavy, bulky, and awkwardly-shaped material is in question, a good deal of thought may with advantage be given to this aspect of the matter. Where heavy castings and forgings are stored, some portion of the stores area should be served by an overhead traveling crane. Where smaller castings, too heavy to lift by hand, but not large enough to merit a regular traveling crane, are stored, an electrical tractor furnished with a crane tackle will be found useful. To employ such an appliance usefully, the width of alleyways and the reach of the crane arm should be duly considered. Long things, like tubing and rods, must be placed so that they can easily be drawn out of and placed in their racks without blocking alleys. The alleys alongside bins and drawers where small articles are stored may be reduced to a minimum, but should be wide enough to admit a wheeled truck or platform on which stores may be placed for distribution. All alleyways should be thoroughly lighted, particularly those where materials are kept in drawers. Most storerooms are very deficient in this respect, yet nothing is more conducive to error and loss of time than imperfect lighting.

#### ROUTINE OF STOREKEEPING

**53. Simple Nature of Storekeeping Routine.**—The main operations in storekeeping are few in number and simple in character. Such difficulties as arise are caused, not by any complexity, but by the very large numbers involved. The work consists of innumerable transactions, many of them quite trifling, but in each such transaction there is ample opportunity for error. In proportion as the effort is made to make storekeeping exact, as it should be, difficulties show themselves. Nevertheless, exactness is largely a matter of habit and routine. The introduction of exact methods for the first time is commonly a discouraging affair, because innumerable examples of laxity are generally uncovered, and the reiterated assurance of every one that the proposed method is impractical may seem only too true. The executive who grasps the simple principles



involved will, however, be able to distinguish between real difficulties and those due to a too easy standard of efficiency on the part of the persons concerned. He will see that what is called for is merely a habit of thinking with reasonable accuracy, and acting in the same manner. By degrees, if pressure is kept up, men will begin to appreciate that a hundred articles means a hundred, and not ninety-five or a hundred and three. They will understand that it is mere laziness to put things down otherwise than in the appointed place; that they must return articles to their proper bin; that nothing must be given out under any circumstances without a written memorandum of issue; when these lessons have been learned, an approach to real storekeeping will be possible.

**54. Three Main Divisions of Routine.**—There are three principal divisions of storekeeping routine, each dealing with a different aspect of the work. First, everything that relates to the receipt of goods, up to and including their distribution to their allotted receptacles; second, everything that has to do with the issue of materials to the plant, from the presentation of a demand voucher to the handing over of the articles; third, everything that relates to the recording, at one point, of the quantities and values involved in the operations named; such recording includes making the necessary deduction to determine the quantity left on hand, always with a watchful eye on the prescribed limits. Requisitioning for a further supply of articles, and watching until they arrive, may be considered as part of this third division of the work, which thus includes everything relating to balances. Receipts, issues, and the maintenance of balances make up the principal responsibilities of the storekeeper, as regards routine operations.

**55. Routine of Receipt and Acceptance of Goods.** Incoming material is usually received by a receiving department, to which all goods, arriving by any route or means, are delivered. This department examines the package for physical condition, and signs the carrier's way-bill. The goods are then unpacked and the storekeeper is notified. If a specification and tests are involved the technical department makes

its examination and issues its certificate that its conditions have been complied with. The consignment is then taken into stores and an entry is made in a stores received book. If the goods are new to the stores, they must be given a location, and a stores reference number corresponding. A ledger card is made out for each item, the price is entered on the pricing index, and they are then put away in the location assigned. If the goods are merely a fresh supply of items previously carried in stores, they are put away as soon as they have been recorded on the stores received book. The consignment is, of course, checked as to number, weight, size, etc., to see that it corresponds in all respects with the order, and with the advice note or bill. The stores received book is a journal from which entries are posted to the debit or charge side of the ledger cards.

**56. Routine of Stores Issues.**—The routine operations in connection with the issue of stores to the productive departments are even simpler than those relating to their receipt. The storekeeper, or his issue man, has merely to honor drafts presented by the persons wishing to get material, when signed by a recognized authority. These drafts are termed material vouchers or stores issue notes. They specify, (a) the item required, with its identification by the stores reference number, and (b) the quantity, weight, or number required. Other information as to the destination of the material, after it is withdrawn from stores, is also given, but has nothing to do with storekeeping as such, any more than a banker has any interest in the question of how the money drawn out on a check is spent. On presentation of the voucher, the issue man gets the material and hands it to the person presenting the voucher. The voucher is then handed to the storekeeper's office for record on the stores issues book. This book is a journal from which entries are posted to the credit side of the stores ledger cards.

**57. Balances.**—The routine of receipt, terminating in an entry in the stores received book, and that of issue, ending in the acquisition of a discharged material voucher, and entry on

the stores issue book, have now been described. It remains to show how these records are applied to control balances, so that the quantity of any item shall not fall below the fixed minimum.

**58. Stores Item Ledger Cards.**—Each item is given a separate card. These cards are known by, and bear, the stores reference numbers as well as a description of the item. They are filed in the order of those numbers and letters. In the simplest case, all that is necessary is to enter, on the left or debit side of the card, an account of the quantities of the item as received, and on the right or credit side entries are made from the stores issue book, giving the amount of material issued. After each fresh transaction, a balance is struck, which balance will of course give the quantity of the item remaining in stores. The maximum and minimum limit for the item is prominently displayed on the card. Each time a balance is struck, it is compared with the limit. If this balance is close to the limit, the storekeeper is advised, by an entry on a stores wanted book. He then proceeds to requisition for a further supply. It will be seen that the routine is quite automatic, but implies vigilance on the part of the clerk, when striking balances, to note and report when an item is close to the inferior or danger limit.

**59. Further Control by Stores Ledger Cards.**—The development of automatic foresight is sometimes carried a stage further. Fig. 9 represents a ledger card (in diagrammatic form only) that illustrates this application. As hitherto described, the ledger card only shows one thing, namely, what is the actual balance of each item on hand. In highly organized plants, more than this is required. The fact so ascertained requires extension in both directions, namely, as to what may be on the way, and as to expected or ascertained future uses. In addition to the *received*, *issued*, and *balance* columns of the ordinary ledger card, two new ones are provided. On the left will be seen one headed *On Order*. Near the right will be seen one headed *Allotted*. The actual difference between the *received* and *issued* columns is 2,000, but a reading of the

card will disclose these facts: (a) 1,000 articles have yet to be received out of 5,000 ordered; (b) 1,000 have been earmarked or allotted to production orders now in sight; (c) a free or unreserved balance of 1,000 is in hand. The earmarking or reserving of items in this way is very much like the certification of a check. A material voucher is presented, but instead of being honored at sight by the issue of material, it is simply indorsed as being reserved, and the material is then held, safely, until it is wanted. When the material is

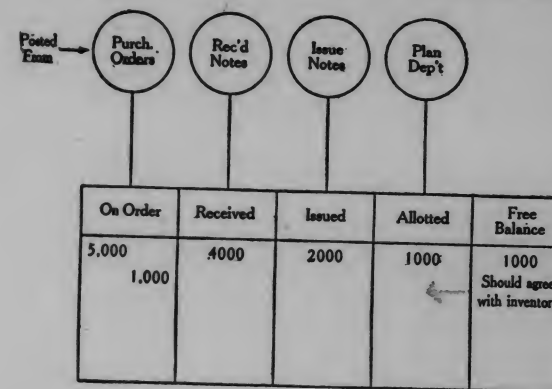


FIG. 9

actually issued, the entry is canceled in the allotted column and entered in the issued column as usual. It will be seen that a wider grasp of the movements of material is obtained in this way.

**60. Adjustment of Price Differences.**—In the case of a new supply of an item that is already carried in stores, it will often happen that the new lot has been purchased at a different price from previous lots. It will also happen that the old supply is not entirely exhausted when the new one comes. There are, then, in the one receptacle, two lots of the same material—one lot at the old price and one lot at the new. At what price is the combined lot to be issued? There

are two methods of procedure and each has its advocates. One way is to average the cost of the combined lot and to make a new (average) price. The other is to take precautions to issue the old at the old price till it is exhausted, and then use the new price. Each of these plans has its earnest advocates, but as a matter of fact there is very little to choose between them. Perhaps the safest way is to average the price as soon as the new entry is made in the ledger, and to enter a new figure on the pricing list. The executive should select one method or the other, but only *one* such method should be allowed. The accounting must not be done in one way at one time and in a different way at another time. A uniform method is essential if serious error is to be avoided, and in most cases the averaging method is the safer.

**61. Finding Index.**—The way in which stores reference numbers are originated has already been explained. Fig. 10 shows how they are used. This illustration represents one card of a finding index or, as it may be termed, classified directory of material. The card lists all those varieties of *type 4 cut-outs, 250-volt, cartridge fuse*, that are kept in stores. Similar cards are devoted to other articles, or to definite groups of any kind, as, for example, the different diameters of 3" bolts, of 2" wood screws, of the various grades of glass, paper, and so on. The classification of stores is a much neglected subject, so that every storekeeper will have to make his own. When the task is accomplished, he will have, perhaps, twenty thousand different items, grouped in natural and convenient groups, each group on a card. There may be, for instance, 3,000 groups, averaging about seven items

TYPE FF (Cartridge Fuse) 250 v. Cut-Out.			
2 Wire	1 1/2"	200A	AF3231
	1 1/2"		3232
	2 1/2"		3236
4 Wire	1 1/2"		3300
	1 1/2"		3301
	2"		3303
	2 1/2"		3305
2 Wire	2"	400A	3400
	3"		3405
	3 1/2"		3407
3 Wire	2"		3469
	2 1/2"		3421
	3 1/2"		3425
	4"		3426

FIG. 10

per card or group. The cards will, of course, be arranged in broad classifications corresponding to the regions, *electrical fittings* together, *pipe and pipe fittings* together, and so on. To find an item, refer first to the division, *electrical*; then to the subdivision, *cut-outs*; then to the group, *type 4*, and so to the actual item sought, namely *2 wire 1 1/2-inch*, the stores number of which is found to be *AF3231*.

**62. Price Indexing.**—At some point in the record of production, the material used, as recorded on material vouchers, will have to be priced out. Most conveniently this will be done in the storekeeper's office, each such voucher being priced and extended as it comes in. In any case a price index will be needed to indicate the current official price of each item. The price index is nothing but a copy of the finding index described in the last article, provided with space at the right-hand side for prices. These prices will be the purchase price, plus freight, customs duty, or other additional charges. It will be understood that they are subject to change whenever a new lot of goods has been purchased at a new price. The new price to be entered on the card will usually be, not the new purchase price, but the new averaged price as explained before. The change of prices should be made on the index without loss of time, so that all material given out after receipt of a new lot shall be correctly priced at the new average.

**63. Uses of the Stores Reference Index.**—The index to stores reference numbers has many uses. As it forms a directory of the material that is kept in stores, it will be consulted by every one who has to do with using material in the plant. The planning department will refer to it to indicate material wanted for production orders; repair and maintenance foremen will make out their material vouchers by its aid; the stores-ledger clerk uses it as his guide for classification of cards; the stores-issue man uses it as a location finder in putting away fresh supplies of material; the pricing clerk will use it (with the addition of prices) as his guide for locating prices. Its value to the purchasing department is also obvious. If carefully compiled, and rigorously kept up to date, the index

forms a valuable regulator of routine. Its precise form is a matter of individual preference, but the general idea as described in foregoing articles is an essential feature of a well-managed storeroom.

**64. Continuous Inventory.**—It has now been shown how the storekeeper receives goods, how they are made the subject of a ledger entry, after having been allotted a stores reference number and a location. The issue of stores, with pricing of vouchers, and ledger entry, has also been described. Further, it has been indicated how ledger balances are made up at the close of each transaction. Next must be considered how these balances are checked, so that confidence may be felt as to their trustworthiness. In former days, and even now in old-fashioned plants, balancing and checking up with actual stores-in-hand were put off until special periods of the year, yearly or half-yearly stock taking. This usually involved the closing down of the productive departments for several days or a week or more. Today, this is considered bad practice. As ledger balances of all items are always available for comparison with actual holdings, it is usual to make every day a stock taking day. Every day a certain number of items are weighed or counted and the actual stock compared with that shown by the ledgers. Discrepancies in value are balanced one against another, and the total deficit charged against profit and loss at the end of a month. The number and amount of these discrepancies form a gauge of the efficiency of the routine storekeeping operations.

**65. Requisitioning Fresh Supplies.**—When the balance on hand of any item is reported at the danger limit, the storekeeper proceeds to make out a requisition on the purchasing agent for a fresh supply. The amount to be ordered is determined normally by the maximum limit set for that item. Thus, *cut-out AF3231* may have a minimum limit of 12 and a maximum limit of 50. This implies that as soon as the stock on hand falls to 12, it is reported on the stores wanted blank, and the storekeeper thereupon requisitions for 50.

**66. Watching Progress of Requisitions.**—The storekeeper must not only requisition for the goods, but must also keep in touch with the situation until he actually gets them. Every requisition should bear a due date, i. e., the date at which the goods are expected. Ordinarily he need not trouble further until such due date arrives, but in the case of important items which he has reason to know will actually be wanted at or near such date, it will be his duty to follow up on the control board the progress of the transaction, and if delay is observed at any stage, to make the necessary representations to the purchasing agent.

#### SOME SPECIAL VARIETIES OF STOREKEEPING

**67. Patterns.**—It is by no means an unknown case for wood patterns to be stored so unsystematically that a search lasting for hours, among pieces of wood of all sizes and shapes, is necessary before the pattern sought is discovered. A pattern is often a singularly hopeless thing to identify from its appearance. It often happens that a pattern storekeeper who has grown up with his stock relies on his memory. He identifies his items as a shepherd is said to do with his sheep—by their faces. When such a man leaves, confusion reigns as a matter of course. This is no fancy picture. A record of patterns should therefore be kept, either arranged by simple serial number or else classified on the stores reference number plan. In either case there is required, (a) a written record minutely describing what the pattern is for, (b) a number painted or stamped on the pattern itself, (c) a system of location of the patterns in a pattern store according to their number. Where possible, the number of a pattern should be affixed in raised figures, so that it will appear on the casting. This serves to identify the castings also beyond all question. A file of blueprints referring to the castings, and bearing the same series of numbers as the patterns, is useful in many cases.

**68. Castings and Forgings.**—The preceding article may be considered to apply to castings and forgings also. Great care is necessary to identify such articles if they are not



adequately indexed and kept in numbered location. While patterns are usually kept in a pattern store under care of a pattern storekeeper, castings and forgings are kept in the regular stores under the charge of the general storekeeper.

**69. Lumber and Wood Material.**—Where lumber is used in any quantity, it should be placed in charge of a man having experience of such material. This is necessary not only for its physical welfare, but also that the issue of material on vouchers shall be accurately made. Wood measurement is a somewhat intricate business, quite different from simple weighing and counting which control ordinary stores. Errors are easily made by one unfamiliar with the work.

**70. Tools, Gauges, Etc.**—Small tools and precision tools are subject to purchase and stores routine like any other article, but in machine shops a further stage of routine is commonly involved. Such articles are kept, not in stores, but in a tool room, where they are issued to and taken back from the workers as the work requires. This has nothing to do with storekeeping. As soon as such tools are received, inspected, and entered on the stores books, they are usually issued to the tool department and charged out to it. The storekeeper has no further responsibility for them.

**71. Non-Engineering Plants.**—Nearly all plants have some sort of engineering or repair department, and in engineering industries one stores takes care of all material. But in textile, leather, and other similar trades, the material used in production is not of a mechanical character. In such cases it is usually put in separate charge, and the books and records are kept entirely distinct from those of the mechanical or general stores.

**72. Fuel.**—Fuel, whether coal or oil, is so separate and distinct an interest that responsibility for it is placed on the power department rather than on the storekeeper. In small plants this may not be the case as regards bookkeeping, but the responsibility for its care can hardly be placed on the storekeeper.

### LABOR SAVING IN HANDLING MATERIAL

**73. The Executive's Opportunity to Economize.** It is only very recently that much attention has been given to the problem of minimizing the handling of materials by sheer muscular power. Nearly everywhere there is far too much pushing, pulling, and pawing-over of materials by hand. This is not only, at present wage rates, a very expensive matter, but involves much unnecessary damage to containers and their contents. In most plants the executive will find this a profitable field for study. The subject is a large one, and in these pages it will be possible to indicate only a few of the modern appliances that are being introduced. Both the possibilities and the method of application will vary from plant to plant.

**74. Advantages From Labor Standpoint.**—The advantages of mechanical handling are not confined to saving of time and money. One important consideration is that where tractors and mechanical appliances are employed, the labor concerned is of a higher grade and much more inclined to keep on the job. Cases are plentiful where great trouble has been found in keeping handling crews up to strength, on account of the heavy turnover of labor, while the adoption of mechanical appliances has not only greatly reduced the number required, but has also very largely eliminated turnover.

**75. The Use of Skids and Transveyors.**—One of the simplest devices for saving unnecessary handling is the *skid*, sometimes called platform, used in connection with either hand-lifting trucks or *transveyors* or with electric tractors that not only lift the load, but transport it. As will be seen from Fig. 11, the skid is merely a board or platform furnished with two runners. The dimensions shown in the figure apply to large skids used in connection with tractors, although a skid of the size shown can readily be hauled short distances by special types of hand machines. A smaller type can be moved by hand machines but not by tractors. Each type has its special applications.



**76. Electric Elevating Tractors.**—The illustration in Fig. 12 is a diagrammatic representation of an electric tractor capable of handling skids of the dimensions shown in Fig. 11.

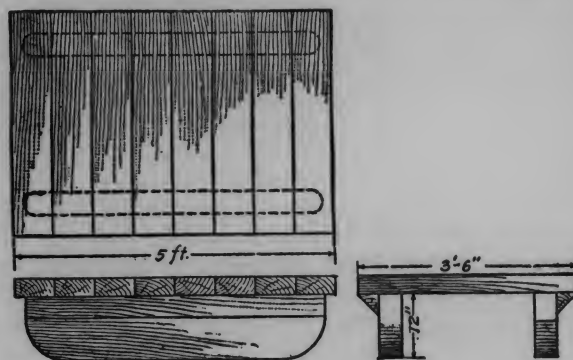


FIG. 11

In front of the tractor is a long, narrow tongue or platform supported on small wheels, and carrying a steel apron that can be made to rise or fall by electric power. In moving skids, the tractor is run up to the skid so that the apron slides *under* the

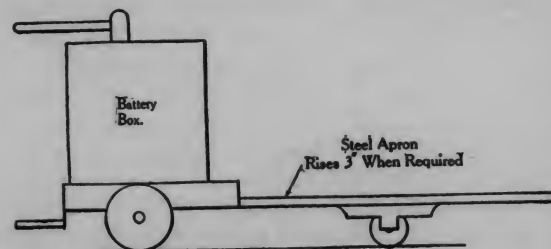


FIG. 12

body or platform of the skid. The gear is then set in motion, the apron rises and lifts the skid off the ground about three inches. The tractor is then free to run, under its own power,

wherever it is desired to deliver the goods. On arriving at the destination, the tractor stops, the gear is set in motion, the apron descends, the tractor backs out, and the skid is left behind on the floor.

**77. New System of Handling Introduced by Skids.**—The skid and tractor are not merely a method of transport. Their proper use involves a new system of handling materials. An actual example will perhaps demonstrate the principle most conveniently. In a certain stationery-making plant, it was usual to receive paper in reams, flat, from cars at the depot, and keep it in stores till wanted by the cutting machines. This involved the following handlings:

1. Unloading at railway car, stacking on road truck.
2. Unloading at receiving platform, delivering to stores on wheel truck.
3. Stacking in stores.
4. Taking down from stack and loading on wheel truck.
5. Delivering to cutting machine room.
6. Unloading from truck and stacking on floor.

When the skid system was introduced, the skids were taken in the road truck to the depot, and the following was the series of operations:

1. Unloading at car, stacking on skids.
2. Transporting skids from receiving platform to stores.
3. Transporting skids, as wanted, one by one, from stores to cutting machine room. Skid left on the floor.

In other words, all handling between the first unloading from the car and the final handling from the stack into the cutting machine was entirely eliminated. It will be observed that this was not a saving in transportation distance, since the goods followed the same path, but a very great saving in handling the goods over and over unnecessarily. Since every such handling of paper tends to damage some of the sheets, a still further saving was effected. Also, of course, the whole process occupied far less time. Unloading of the road truck was effected in a fifth of the time, while the wheel truck was not used at all.

**78. Principles of the Skid System.**—The general principle is to get the material on to skids at the unloading point, transfer it to stores on the skids, and if the nature of the goods and processes permits, keep the material on skids in stores and deliver it to the point of use without disturbing it. This cannot always be done. Smaller quantities than a whole skidful may have to be delivered. Even then it may pay to take the full skid to the point of use, remove the material wanted, and to return the skid to stores. Where space is precious, it is possible to put skids in tiers, by means of a special

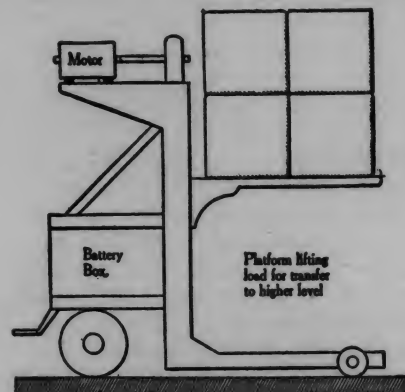


FIG. 13.

electric tractor tiering machine, as shown diagrammatically in Fig. 13\*. In this machine the movement of the apron, instead of being only a few inches, is about four feet; by the aid of special racks it is thus possible to place one skid above another. The skid principle is, however, best adapted to plants that have plenty of floor space available for storage purposes. New stores layouts can be specially designed to obtain the best advantages of the system, ramps, or inclined planes, being used between floors instead of elevators.

\*This type of machine will also deliver to railroad box cars from the track level, thus obviating the expense of loading platforms.

**79. Method of Arranging Skids in Storage.**—The illustration, Fig. 14, shows how skids should be *staggered*, or placed at angles, to permit of quick handling. The tractor has only to make a half turn to put away or withdraw a skid. In one plant where gray cotton bales are stored, several thousand bales, two or three to a skid (according to size) are stored on this plan, the storage space covering nearly two acres of basement. The bales are received through a chute from cars, weighed, placed on skids, put away, and when wanted are taken

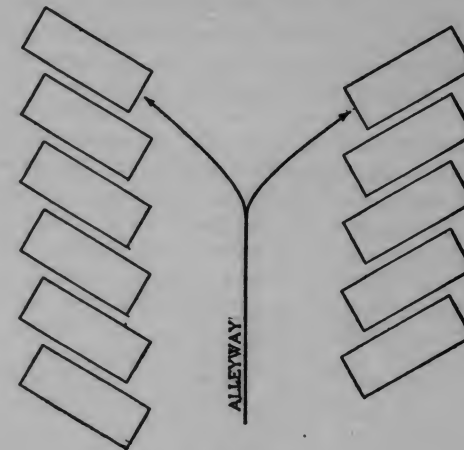


FIG. 14

out and run direct to the "gray room" where they are opened up for process work. The long strings of laborers, laboriously pushing baggage trucks with one bale on each, which were formerly a familiar sight in this plant, are no longer seen, and very much quicker and surer location of any particular bale when wanted is effected than formerly.

**80. Hand Tiering Machines.**—In addition to the electric tiering machines just described, hand tiering machines can be obtained which will operate in comparatively narrow alley-

ways. These are used for placing barrels and kegs in racks, stacking bales in piles (where it is not required to get at individual bales), stacking cases of goods, and in general elevating any object of moderate size up to twenty or more feet, so that it can be placed on a pile or stack. This type of machine is not, however, adapted for transporting goods. Its only function is to elevate, either by hand or by electric power.

**81. Review of the Handling Situation.**—The brief descriptions of modern methods just given will serve to show the executive a line of approach to the problem under consideration. Once the principle is grasped that the amount of actual *handling* (in the strict sense of the word) should be reduced to a minimum, the practical applications of this principle will readily be brought to mind by making a survey of each class of material in the stores, and asking the question: "are all these handlings really necessary?" The more bulky, awkward, and heavy the material, the greater is the advantage gained in reducing handling. Often also, by having goods packed by manufacturers in certain size cases, kegs, bags, etc., it can be arranged that the unit size thus set up will go through many stages without breaking bulk and consequently with a saving of expense for handling.

**82. Counting Machines.**—Another mechanical device of great value in the stores is a machine which weighs and counts. Where daily inventories are taken it is in fact essential. The principle of the machine can easily be explained. Each machine has two pans, in one of which is placed a stated number of the articles to be counted, say ten, while in the other larger pan, the bulk of articles to be counted are placed. The number is then read off on a beam. When giving out stores by count, such a machine saves much time and greatly promotes accuracy. To count out, say, 167 pieces, is laborious and slow work, and much liable to error. But with the counting scale it is as easy as counting out six or twelve pieces. In inventory taking, the importance of not having to depend on a perfunctory count is obvious, especially when the question of mental fatigue is considered. Inventory taking is monotonous

and uninteresting work at best, and any device that relieves the tedium will certainly promote both the speed and accuracy of the work.

#### EXECUTIVE CONTROL OF PURCHASING AND STOREKEEPING

**83. Points for Particular Attention.**—Although the executive does not under ordinary circumstances come directly into relation with questions of material, it is necessary for him to have a general grasp of the operations on material, in order that their efficiency may be maintained. The points on which his attention should be particularly directed may be divided into two groups: (a) finance and (b) routine.

**84. Control of Investment.**—In many cases there is a tendency toward accumulation of stores beyond current needs. Obsolete sizes and kinds are not eliminated as they should be. In badly organized concerns stores are lost sight of. Fresh supplies are ordered where a sufficient supply, temporarily mislaid or forgotten, is on hand. In a comparatively small plant in which old-fashioned methods had been in use for many years, a rigorous survey of the material situation disclosed fifteen thousand dollars worth of material, raw and partly manufactured, mostly brass and copper, that had been laid away in odd corners and forgotten. This tendency points to the necessity of a systematic watch on the part of the executive as to the value of the balance in hand.

**85. Charting Value of Stores in Hand.**—The illustration, Fig. 15, shows a chart arranged by weeks, on which the weekly balance of stores on hand is plotted. The curve for the previous year may usefully be plotted in colored ink, for comparison with current balances. In many businesses, where seasonal variations play little or no part, the curve of balances will be almost a straight line. In other cases the seasonal variation will yield well-marked peaks and depressions. A chart such as that illustrated enables the executive to see at a glance what is the general condition of stores. The

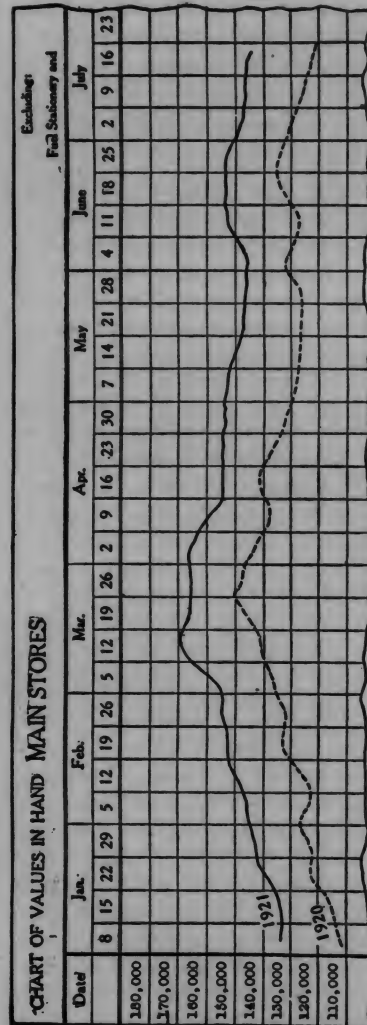


FIG. 15

readings do not convey any absolute meaning. That is to say, they must be read with judgment and a knowledge of what is going on in all directions through the plant. Thus, a sudden rise in the balance may be explained by the accumulation of special material for a large order. A continued rise or fall may be due to urging on or holding off buying on account of market conditions. The chart must be read intelligently to make use of its indications. Only after it has been compiled for a considerable period will it begin to be of service, but once in working order it provides the executive with a simple and useful control over the investment that is locked up in material of all kinds.

**86. Charting the Liabilities of Purchasing Department.** — A method of keeping

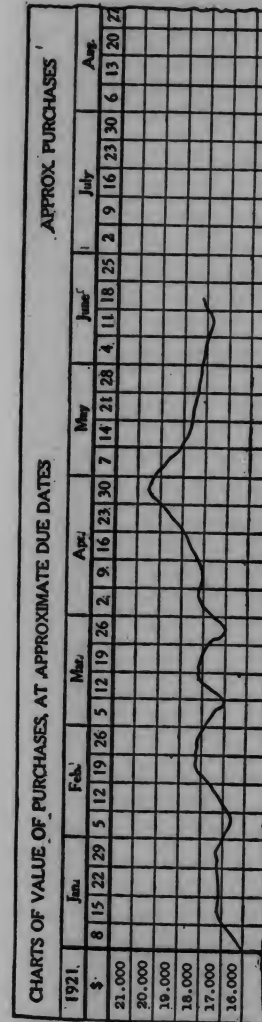


FIG. 16

track of liabilities incurred by the purchasing department is shown in Fig. 16. It is important for the executive to keep in touch with the approaching liabilities that have to be provided for, and by use of this chart a close control is obtained of such liabilities at the moment they are incurred. The orders given out each week by the purchasing agent are classified, first by due dates, and then as to each due date, by the terms of the order as to payment. Thus, in any given week, there may be \$400 worth of orders given out, expected to be billed in 3 weeks, and paid for in 10 days thereafter. Another group, amounting to \$3,800, may be billable in 5 weeks and on 30-day terms. An analytical column sheet kept in the purchasing agent's office will enable these items to be inserted in the column representing the week at which they will fall due for payment. They are then added to any amount already scheduled for payment in the same period. The total is entered on the chart. The curve should be kept in pencil, as it will require alteration when new amounts fall due on



particular dates ahead. By a survey of this curve the executive is enabled with a minimum effort to keep in touch with the incurred liabilities. A second curve may show payments made on purchasing account. This will be dealt with in another Section.

**87. Watching the Cost of Operation.**—It is sometimes desirable, where storekeeping operations are extensive, to chart the combined cost of purchasing and storekeeping, reduced to a basis of cost per \$1,000 purchased. This is, in effect, a percentage basis. A chart thus prepared is shown in Fig. 17. It is of most value when the figures for previous

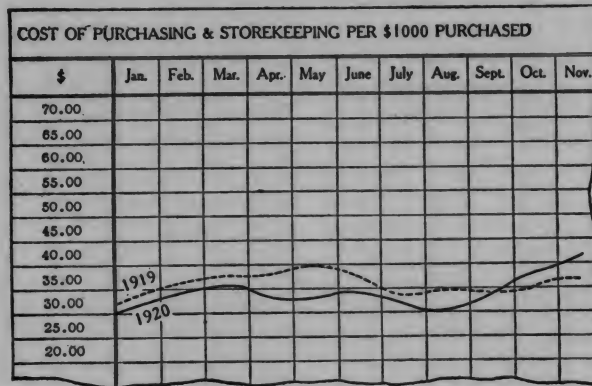


FIG. 17

years have been accumulated and are charted in separate curves for comparison. As with the other curves described, its readings must be made with judgment and knowledge of the circumstances likely to cause variations. Nevertheless, variations in cost will in all cases suggest inquiry, though no hasty assumption must be made that anything is wrong. A steady curve, on the other hand, may be equally suggestive of a cause for inquiry, if it is known to be coincident with a shrinkage of business. Experience in a particular plant is necessary to derive benefit from the curve, but as in the other cases, when

once established, the curve will be found a concise method of control.

**88. Control of Efficiency in Routine.**—There are two principal directions in which the executive may keep watch in order to control the efficiency of routine operations. One is with regard to delays and the other with regard to errors. It is very important that responsibility for delays shall be localized, and classified, so that blame shall fall on the right shoulders. The errors referred to are mainly those of incorrect storekeeping, leading to discrepancy in inventory.

**89. Classifying Causes of Delays.**—The control board holds a record of the time-history of each requisition, and consequently also of delays. The only other cause of delays will be the default of the planning department or the storekeeper in not getting out requisitions promptly. One method of control is to cause the productive department to report, as a matter of routine, all delays in obtaining material, and having each case investigated, by aid of the control board record, and the cause assigned. Results should be tabulated under the various heads, such as *delay in issuing order*, *delay in filling order*, *delay in transportation*, and so forth. By degrees a body of information will be acquired that will enable the executive to judge whether measures should be taken to expedite routine in any department. A more thorough method is to supplement the foregoing steps with an abstract taken weekly or monthly from the control board, showing the actual number of days taken by each stage of a requisition, and thus finding the average time taken in each stage.

**90. Errors in Storekeeping.**—Inventories will be taken every day, as described in a preceding article. In many cases discrepancies will be found between the tale of articles actually located by count or weighing and the figures shown by the stores ledger card for the item. The balance of such discrepancies, i. e., the net loss or gain, will have to be written off in the profit or loss account. To effect this, it is usual to rule the inventory sheets with cash columns, so that the amount



over or under of each item, may be extended in either the loss or gain column as the case may be. An abstract of this information should be prepared for the executive. Such an abstract should show: (a) The number of items found incorrect; (c) the number of articles and the value of the maximum gain and the maximum loss; (c) the net gain or loss. These weekly results should either be charted or tabulated in the executive's office so that a running comparison of the errors may be made. Any tendency to increase will thus be readily observed, or if the average is high and shows no signs of reduction, it will suggest that steps be taken to inquire as to the causes for this unsatisfactory state of affairs.

**91. Conclusion.**—It will be observed that the executive's control over material rests largely on the principle of exceptions. His attention is called to matters when they are ceasing to be normal. Rising investment, unusual liabilities being incurred for purchases, abnormal cost of operation, excessive delays, and too high an average of errors, are the things that will call for action. When everything is proceeding normally, a glance at the charts and reports will show that this is the case, and he can then turn to other work without the necessity of more detailed examination. But a thorough grasp of the general routine both of purchasing and stock keeping is necessary in order to apply the proper remedies for unfavorable conditions when they are found to exist.

#### EXERCISES

- (1) Explain the distinction in the use of the terms *stores* and *stock*.
- (2) Indicate how it may at times not be to the best advantage to buy from the lowest bidder.
- (3) What is a *skid* and how is it used?
- (4) Explain the principle of the counting machine, as applied to stores of articles that are used in large numbers.
- (5) Explain fully the use of a system of stores reference numbers such as *EM3216*.
- (6) Name the three fundamental factors of success in purchasing, and show how they conflict and necessitate a compromise.

(7) Explain two different methods by which the prices of goods in stores may be adjusted to fit in with changes in purchasing price.

(8) Describe the use of a control board to keep note of purchasing operations. Show how it gives instant answer to a number of important questions.

(9) (a) Indicate the advantages of centralized storekeeping. (b) In what circumstances may it be advantageous to depart from such centralization, and what principle should, in such case, be carefully observed?

(10) Describe a system of storing patterns.

## CHAPTER V

### THE EXECUTIVE AND THE FACTORY

#### NATURE OF FACTORY OPERATIONS

**1. Meaning of the Term Factory.**—At the last census of manufactures in the United States there were enumerated some 275,000 establishments classed as factories. These range from minor enterprises, employing little more than the owner and one or two assistants, up to mammoth undertakings having many thousands of men on their payrolls. It is very pertinent to ask, What is the distinguishing feature that links together establishments so varied in size and importance? The answer is a simple one: a factory is a place in which material is transformed by the aid of labor, or of machinery, or of both together. It may also be defined as a place in which technical knowledge is applied so as to effect the transformation of original or raw material into a new form. It will be found also that such transformation is effected by technical skill, which may be embodied in machines or exercised by hand. A more complete definition of a factory is, therefore: a place in which, in the light of and under the direction of technical knowledge, material is transformed into a new form, by the aid of technical skill, applied either by hand or by machine.

**2.** The definition given in the preceding article is, however, still too narrow. For, although it might well cover all the operations of a simple blacksmith's shop, for example, as soon as the work passes beyond such simple stage, the necessity

arises of embracing within the definition the various functions involved in production. In all but the smallest plants, special activities are devoted to work which is not directly concerned with the transformation of material. Thus, for example, one man, at least, will be engaged in purchasing and the care of material, another will be engaged in registering, dissecting, and doing the paper work of orders, a third will devote all his time to moving material into the shops and fetching away the finished product. All these activities are so many separate services rendered toward actual production, but they are not in themselves production. They do not by themselves transform a single piece of raw material into another form. Nevertheless, they are obviously indispensable. It is evident that an inclusive definition of the factory should embrace these typical functional activities.

**3. Services and Functions.**—In the sense in which the term will be used in this discussion, a *factory* may be defined as *a place in which material is made over into new forms, by the aid of technical skill directly applied to it by hand or machine, assisted by various indirect services organized for cooperation, under the guidance of technical knowledge.* It is important to bear in mind this definition, as it will serve as a guide in forming a comprehensive view of the relations of the executive toward the factory activities. It will be observed that the definition pictures an organized body, with diverse activities going on simultaneously, but all contributing to one common end, namely, the transformation of material into new forms. An analysis of factory activities shows that they may be reduced to a few clearly marked groups. One of these groups is concerned with direct work on material. All the others deal with the indirect services to production. These activities considered as groups are called functions. Thorough understanding of their scope will enable the executive to get a good grasp on the essential efficiencies to be developed and maintained in factory operations.

**4. Value of Accurate Analysis of Functions.** Before proceeding to consider production functions in detail,

it may be well to ask whether these definitions have any practical aim, or are merely arbitrary and academic distinctions. The question is best answered by considering a hypothetical case. Suppose that in a certain factory the result of operations is obviously unsatisfactory. Dissatisfaction may be of various kinds. There may be complaints of faulty work; a long list of broken promises of delivery; product may be good, but its cost too high; quality may not be uniform; continual annoyance from errors in carrying out customers' instructions may develop, and so forth. Now if ideas are clear regarding the different factors that contribute to production, the location of faults will obviously be made easier. Take, for instance, broken promises of delivery; whose fault are they? The old-time executive did not know. He simply went out and raised trouble with every one; he fell on the just and the unjust alike. But the modern executive with a clear plan in his mind of the way in which his organized services are working, knows very well where to look for the source of trouble. Very little inquiry will inform him as to where the weakness lies, and he can then apply the necessary remedies without disturbing persons who are not to blame.

**5. Scope of Present Discussion.**—The subject of factory operation is a very wide one, and several volumes could be filled with a discussion of its problems. In this section, however, attention will be restricted only to such matters in factory management as are of direct interest from the point of view of executive control. It is important, for example, that the executive shall understand the principles of layout of the space and the equipment devoted to factory operations; he must be able to distinguish between the part played by original design and that played by subsequent control in the turning out of product; he must grasp the modern principle of consultative, or, as they are sometimes called, *staff*, functions, and the way in which responsibilities are allotted among the factory personnel; he must know what kind of information to call for, so as to be able to compare the efficiency of one period with that of another; and he must be able to distinguish between

efficiency arising from good organization of services and that arising from successful technical operation. It is to these matters rather than to the detail work of the factory that attention will be given here.

**6. Production Functions.**—The various points enumerated in the last paragraph, to which the executive must give attention, correspond to what analysis has revealed as the *five organic functions of production*, namely, *design, equipment, control, comparison, operation*. All activities that are strictly factory activities can be reduced to these five groups.

#### DESIGN

**7. First Step.**—Before anything can be made, or any consideration devoted to questions of machinery, buildings, staff, etc., it is obvious that plans must be clear as to what is to be made. In other words, something must be designed. Many business failures arise from ignoring this very obvious thing. In proportion as an industry employs specialized machinery, vagueness at the outset as to what class of business is to be done spells failure. In the printing trade, for example, many failures occur either because the wrong kind of machinery for the class of trade undertaken is installed (perhaps because such machinery happens to be available second-hand); or for the reason that, with a given equipment, the wrong kind of business is invited. It is clearly important, therefore, to know at the outset, before a machine is installed or a wheel turns, just what is to be accomplished, or, in other words, what is the *design* in view.

**8. Elementary and Complex Design.**—The use of the term *design* in the sense of the preceding paragraph is very elastic. In establishing an ink factory, for example, the fundamental thing required in the way of design is a reliable formula. This can be written on a small sheet of paper. Even in this simple case, however, the act of design can not be said to have been completed unless such points as bottling, sealing, labeling, wrapping, and packing have been covered. All these

steps are part of design. It would be very foolish to give out a single contract for the new factory unless all these points had been settled and reduced to working instructions. Even with all this the hypothetical ink factory represents a simple case. Design, in its most complex development, though exactly the same in principle, requires, partly through the multiplicity of detail, and partly through the difficult technical questions that arise, a large well-coordinated staff, or, in other words, a regular department of design. In a mechanical industry, this is represented by the engineers and draftsmen; in a chemical industry, by chemists and engineers combined; in other trades, by technical experts of various kinds with or without engineers. It will easily be understood that faulty or careless design vitiates the whole performance. The most perfect factory system, running like a watch, cannot make up in the slightest degree for bad design. This is a lesson that is often purchased at a great price.

**9. Design in an Established Business.**—In a going concern design is chiefly concerned with new kinds of product. Some industries, as, for example, the building of large machines, require elaborate sets of designs for each new order. In others, as, for instance, sewing machines or typewriters, of which a large number are manufactured in identical form, design is chiefly concerned with improvements on the one hand, and with special adaptations on the other. In the finishing of textile fabrics, which is partly a chemical and partly a mechanical industry, every new kind of cloth handled requires study and experiment before a decision as to its proper treatment is made. In printing, both paper and ink are sometimes unknown quantities, and experiment is necessary to adapt each to the other and decide on the proper machinery to use. In all these cases there is the same underlying principle: *an ideal or standard product must be fixed in the mind before manufacture is begun.* In a mechanical industry the end in view is the production of a mechanism that will do some specified task; in a finishing business there is a customer's sample of shade or finish or both to be duplicated; in a printing concern some

specified effect is usually sought, often dependent on a sample also. Even in a plain piece of printed text, there is always the standard of the house to be attained. For, as any one knows who has bought printing, the same text, in the identical type and on the identical paper, will have a very different appearance when turned out by one printing house and when manufactured by another.

**10. Design as Product Specification.**—Design indicates the aim to be attained with more or less definiteness according to the needs of the case. It follows that design also indicates tests. A piece of steel must be machined to certain dimensions, and must pass certain limit gauges. A piece of cloth must match a sample piece in color and texture. Even in the simple case of the ink factory, it is desirable that suitable tests or standards should be indicated, such as fluidity, color, light-fastness, etc. Design therefore embraces, first, the shape, size, dimensions, surface, color, or other physical properties of each component of the product and of the product as a whole, and second, the tests to be applied to insure that this specification has been complied with. It should not be lost sight of that design is in all cases a technical function. It demands technical knowledge, not only of the uses of the product but also of the productive operations (which are the application of technical skill to material) and of how these can be made to bring about the desired changes in the raw material. While the principles of control, comparison, and equipment are common to all industries, design and operation are essentially technical.

**11. Responsibility Resting on Design.**—This is the first application of analysis of functions that the executive must keep in mind: Design must bear its own burdens; it cannot pass them on to other functions for remedy. This applies in many ways. A clumsy design of a machine part costs money; there is no remedy but simplifying the design. If a mechanism fails to perform its expected task, the first thing to investigate is whether it was, in fact, made exactly as specified; if so, the failure lies in design. A batch of ink is



found to thicken in the bottle. Was the specification of materials and processes (which may include such things as temperature and purity of water) faithfully carried out? If so, the design, that is, in this case, the formula, is the thing to be critically examined. Is a certain line of goods costing more than was estimated, and if so, why? If the answer is: because it is necessary to take special precautions to keep the material cool, or prevent it buckling, or keep it from sticking—then this was a condition unforeseen in design, and the design is the thing that requires attention. The importance of knowing where design begins and ends is thus manifest. No rules can be given regarding this. The line of demarcation varies from industry to industry and from plant to plant. But every executive should plot out for himself just where his function of design starts and ends, and must make sure that every step of it is in competent technical hands.

#### EQUIPMENT

**12. Range of the Equipment Function.**—Equipment is defined as the function which establishes conditions for production. It thus embraces the planning and provision of buildings, power plants, transportation appliances, and the machinery used in actual operation. In establishing a new business, the question of equipment naturally follows on that of design. Having obtained a clear idea of what is to be made, the next step is to provide the physical equipment for making it. A good deal of designing is involved here. Such designing is not, however, to be considered as part of the specific function of design, because that function has to do with designing the product only. The subject of the planning of equipment, including the layout of buildings and machinery, has only of late years obtained adequate attention, but has rapidly come to be recognized as a very important feature in good management. The necessary equipment having been planned and provided, there still remains to be arranged the upkeep and running of such equipment, and the furnishing of power, lighting, ventilation, sanitation, fire prevention, sprin-

gling, repairing, and maintenance services, all of which is included in the function of equipment. As all these things are matters of engineering, equipment may be considered as the engineering function. It should be noted that the function of equipment *makes* nothing. It adds nothing to product *directly*; all it does is to establish and maintain efficient conditions under which operation, that is, direct work on material, may take place.

**13. Problem of Buildings.**—Before anything else, buildings must be provided. Unfortunately this necessity frequently leads to very hasty decision as to the kind of building acceptable, with results that bear bitter fruit in later years. Nearly every firm of more than twenty years' standing, and many younger ones, can supply an example of this. In old times, as may be seen anywhere in country districts, the idea that a factory would expand was quite generally ignored. In many sections of the country mills are found built of stone, very much like large private houses, with small windows and solid walls, and mostly without the slightest provision for adding extensions of any kind. At the time these were put up, the prevailing type of factory building was a simple box of stone, brick, or wood, of one or more stories, and the idea that different kinds of industry might with advantage use different types of buildings, was almost unthought of. Today the idea of planning the building to meet the requirements of the industry, instead of forcibly cramming the necessary equipment into a stereotyped building, is pretty generally accepted. An executive about to take charge of a new project must make it his special task to look after the adequate planning of buildings, once the design of product has been decided upon, together with the operative machinery that it implies.

**14. Layout of Machines.**—The selection of operative machinery goes hand in hand with the design of the product, where an industry is being started. The specific design will, or should, depend on specific machines being employed. Therefore it may be assumed that a schedule of the required machinery is at hand. The next question is, How should this



machinery be arranged? A rough idea of the sequence of operations is necessarily impressed on any one who is planning a new industry. But modern analytical methods have shown that many points should receive careful consideration. It is not simply a matter of fitting machines into a given space like a jig-saw puzzle. Certain principles must be observed. The first of these has to do with the path of travel of material in process. A cardinal principle of modern management is to avoid handling material as much as possible. Every handling costs money and involves delay. But unfortunately there are also opposing considerations, so that every problem must be solved individually after all the circumstances have been weighed.

**15. Straight-Line and Group Layouts.**—In many industries there is no question whatever as to the manner in which machines should be arranged. The layout is dictated by the fact that processes are continuous, and that there are no alternatives to choose from. In such a process as soap making the product passes through a large portion of its career in liquid form; it is simply pumped from one tank or vat to another. The raw material, tallow, oil, etc., is also piped in a molten state. Steam, hot water, and caustic soda are similarly handled. The by-products, such as glycerine, are also piped. In such circumstances the relative position of departments, and even to some extent their distance apart, are not matters of prime importance. It is only after the soap has become solid, in the drying, cutting, tableting, wrapping, boxing, and storing stages, that layout becomes of vital interest. But in another class of industry, especially in machine work, the desirability of so disposing operations that the product passes from one machine to the next immediately adjacent is often more or less in conflict with the requirements of technical supervision and maintenance. If fifty machines of one kind are placed in one room an expert can be put in charge of them all, thus insuring the best results both as to quality and quantity; special repair men, qualified experts in keeping just that type of machine in the best condition, can also be

attached to such a battery of machines. But if the fifty machines are scattered about the plant in groups of, say, ten machines, evidently there is a loss—it may be an unavoidable loss—of efficiency.

**16. Compromise Between Possible Arrangements.**  
Two ways in which the problem stated in the preceding article

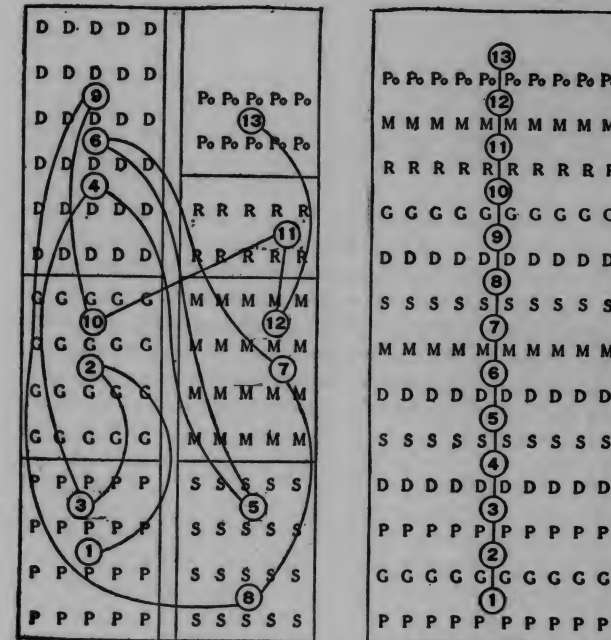


FIG. 1

can be solved are illustrated in Fig. 1. On the left is the grouped or *departmental arrangement* of machines. On the right is the *straight-line arrangement* of the same number and variety of machines. From what has just been said it will be seen that while advantages in the way of supervision and easier upkeep are sacrificed by the straight-line arrangement,

on the other hand, great advantages with regard to movement of product are gained. On the grouping plan it is evident that considerable time and expense will be absorbed by the mere moving of the material from one department to another, whereas in the straight-line plan a regular and orderly progress of material takes place, possibly without involving any charge for moving at all.

**17.** Which then of the two foregoing plans is the better one? No answer can be given to cover all cases. One factor is the size and weight of the parts to be handled, another the actual amount of skilled supervision demanded by each type of machine. Individual problems must therefore be worked out and the arguments for and against duly weighed. One thing may be noted, however. If it is not certain that the product will always follow the routing as laid down in the straight-line plan, or if it is probable that some day new processes may have to be inserted in the routine, then preference will be for the departmental method, other things being equal. The grouping plan is absolutely flexible. Product can visit each group of machines in any order. On the other hand, the straight-line arrangement is very inflexible. Any departure from the natural routine will cause a great deal of confusion and inconvenience.

**18. Principle of Minimum Travel.**—The glimpse given in the preceding articles of the problems involved in layout will suffice to show that these problems are not to be glibly solved by a hasty sketch or a half-hour's discussion. Upon due and careful consideration of the facts involved much of the future efficiency of working will depend. Furthermore, having determined the arrangement of machines within each department, the relations of these departments themselves must next be considered. For just as the principle of minimum travel of material within a department is important, so also does the same hold true as regards the factory as a whole. Departments should be so located in reference to one another and to the source of raw material (stores) and to the warehouse for finished material (the stock room) that the path of travel

is as short as possible. Naturally this question of layout is much more important in some industries than in others. In industries dealing with heavy materials and articles it is very important; in others, dealing with bulky stuff where, however, movement can be controlled by mechanical appliances, layout is less important; in industries dealing with very light goods, layout will be important in proportion to the volume carried between departments. In industries in which movement is controlled by liquid transportation, the layout is sometimes of very small consequence. Nevertheless, as a general rule to be observed, unless there are clear reasons why the principle should not apply, it may be said that departments should be arranged with a view to minimum travel of raw material and finished or part-finished product.

**19. Desirability of Keeping Expansion in View.** Another factor that must not be lost sight of is the prospect of future expansion of a projected plant. In many cases this feature is ignored in the making of plans. Various reasons may be assigned to account for this. One is the influence of the architect, who has a strong bias in favor of a building or set of buildings complete at all points. Another is the fact that at the time of construction attention is being focused on a plant well adapted for present uses, and that this is considered to be a sufficient problem for the moment. The result is, too often, that a handsome, architecturally adorned, absolutely inflexible type of building is erected, into which the required machinery just fits and no more. A few years later, if the business is successful, it is suddenly discovered that there will be the greatest difficulty to provide extension without great expense, and even then the layout of the factory as a working unit will be altogether changed, probably not for the better.

**20. Expansible Layout in a Heavy Industry.**—In plants employing large and heavy machinery, arranged by departments, and especially where it cannot be foreseen which of several departments will grow the fastest, the type of building shown in diagrammatic form in Fig. 2 is advantageous.

This is a type of building which originated in the English textile industry. On the south side of the main alleyway will be seen storerooms for goods in process, each of which serves the department immediately opposite. On the north side are the productive departments, one-story buildings lighted by monitors or saw-tooth roofs. Raw material is delivered into the first storeroom and taken as required into department *A*. The part-finished product from *A* is delivered into the *B* storeroom, thence into department *B*, and so on. One point to be noted is the flexibility of delivery to any department. Thus

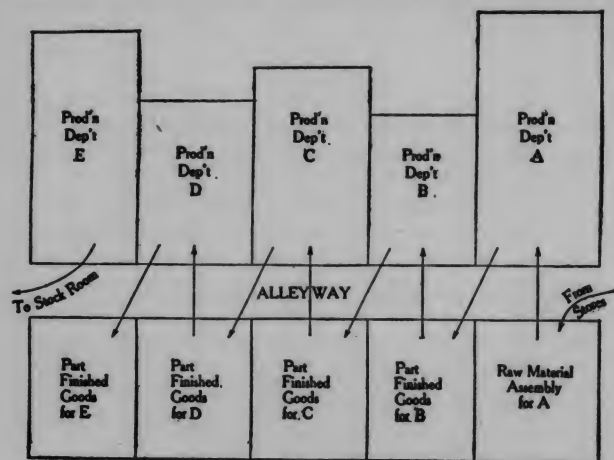
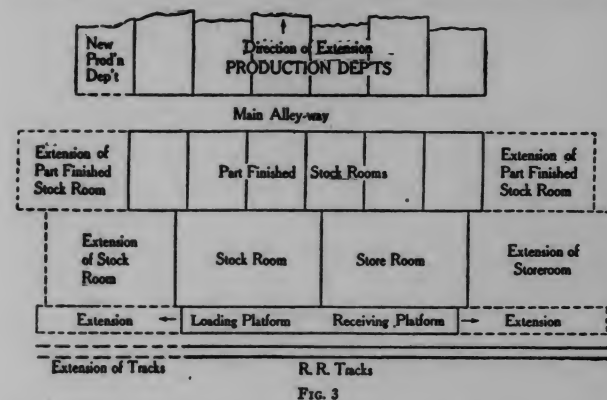


FIG. 2

it may be that some product does not pass through all departments from *A* to *E*. It may follow the series *A, C, D, E* or *A, B, D, E*. Or it may, in some cases, turn on its tracks, and be routed *A, B, D, B, E*. But any one of these routings is as easy as any other. The other important advantage of the plan is that each of the departments *A, B, C, D*, or *E* can expand indefinitely at its own rate of progress, without interference with other departments. In some kinds of business this is a very important feature.

**21. Example of Growth of Plant.**—The illustration in Fig. 3 shows how easily the type of layout just described lends itself to expansion without alteration of the general plan. The storeroom and stock room and their loading platforms, shown by solid lines, should be considered as part of the original layout. From an examination of the diagram it will be seen that: (a) a new productive department has been added; (b) the old productive departments have been extended northwards, each according to its own requirements; (c) the stock rooms for part-finished product have been enlarged and extended to meet the larger production, and a new room has



been added to take care of the new productive department; (d) the storeroom and the stock room have been extended in accord with the increased capacity; (e) the loading platforms and tracks have likewise been extended. Now the main thing to observe is that all this extension has taken place without impairing the excellent layout of the original plan. This is an example of a thoroughly flexible layout, and though this plan cannot always be copied, and though each problem must of necessity be handled on its own merits, the illustration here given is an example of what any plan should aim at, in such industries as are best housed in single-story plants.

**22. Light Manufacturing in Multiple-Story Plants.**—It will be readily seen that the plan described in the preceding article could not be utilized in a building of more than one story, as it is dependent on top lighting. Where buildings are to be constructed of two or more stories, an arrangement like Fig. 4 may be considered. The plant may begin with one story, precautions being taken to have foundations, columns, etc., constructed so that they will carry several stories ultimately. This does not involve great extra expense if planned from the commencement, while to strengthen such members afterwards is a difficult and costly operation. The general idea, as will be seen from the diagram, is to circulate

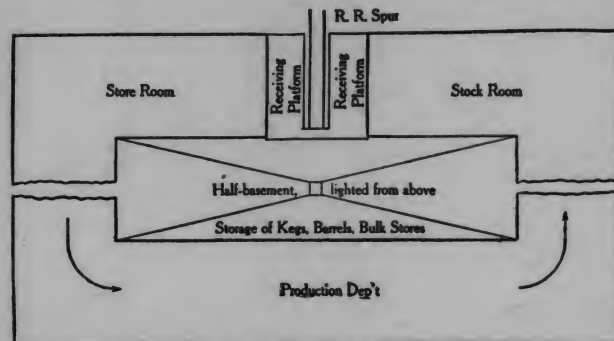


FIG. 4

material from the storeroom through the plant, into stock room, and thence to the loading platform at the tracks. The building will probably be square, with an interior court as shown. The ground floor of this court can be made into a half basement, lighted from above, and used for storage. When extension becomes necessary, it is provided by adding a new story or stories. This may be done several times, up to the limit originally decided by the nature of the foundations. With each addition, the circulation plan, or layout, remains the same. Each new floor is, in effect, a doubling of the capacity of the plant in all its functions. Lighting remains the same. The

floors will naturally be connected by capacious elevators, judiciously placed. Great care should be taken to construct elevators large and strong enough to carry elevating tractors. The problem of handling material will then not increase in difficulty as the plant grows.

**23. Other Construction Plans and Layouts.**—A type of multi-story building that possesses great flexibility, though not perhaps capable of such architectural finish as that described in the preceding article, is shown in Fig. 5. It consists of a main building *A*, with a series of wings *B* on each

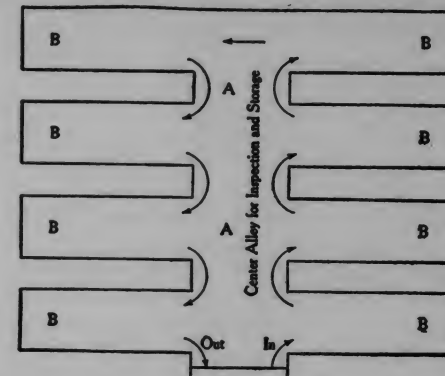


FIG. 5

side. Access to storerooms and stock rooms (not shown) is at one end. The path of travel of material is down one side, in and out of bays, and up the other. Flexibility is preserved by the possibility of extension of the main building *A* with additional wings, or by adding more floors. The wings are in general devoted to manufacturing processes, and the main building to inspection, assembly, tool rooms, storage of part-finished product, etc.

**24. Radial Type of Building.**—The radial type of construction, shown diagrammatically in Fig. 6, crops up every now and then as offering advantages for plant layout. The



idea is that the shops are situated in the spokes of the wheel and the storerooms in the hub. Extensions of the spokes can go on indefinitely, without interfering with the lighting. Not much can be said for this plan. It is obviously very wasteful of space. The longer the spokes, the more ground is wasted. Moreover, there is no possible way in which the central space or hub can grow; hence, a condition of congestion will inevitably follow sooner or later at that point. The plan is one well-adapted to prisons, where it is frequently adopted. The

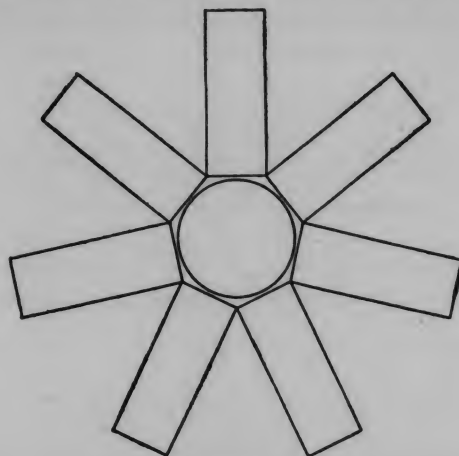


FIG. 6

advantage here is that all the wings or spokes open only into the hub or central space; hence, only this space requires watching. There is nothing corresponding to this in industrial plant economy.

**25. Other Branches of Equipment Layout.**—It has been shown that the executive must have a clear plan in mind as to: (a) what is to be made; (b) the machines by which it is to be made; (c) the plan on which such machines are to be installed and the routing to be followed by the material

in each department; (d) the housing of departments in suitable buildings, so as to allow for expansion while preserving the original relations of one department to another. These are the more important items with regard to equipment to which the executive must give close personal attention. Other points of equipment are more of the nature of engineering matters, which will follow routine engineering practice in most cases. Plans of lighting (both daylight and artificial), heating, ventilation, fire protection, sanitation, and hygiene, all have to be laid out and arranged to the best advantage, but they do not offer any specifically executive aspect. The subject of transport methods is too large and special to be treated here; it will suffice to point out that some industries have had a variety of special conveying and handling appliances developed for them, while others as yet await such development. But this is a problem of engineering rather than of executive activity. The executive should, nevertheless, keep closely in touch with progress in this field.

**26. Power Plant.**—The selection of the components of a power plant is also obviously a technical and engineering problem. But there are certain requirements which should be studied by the executive and impressed on the technical designers. Ample capacity for the peak load, and when possible, ample margin of reserve to cover possible breakdown of units of the power plant, are among these. Another very important point, often overlooked, is provision for expansion without undue expense. Questions of policy will also arise in regard to the size of units. Large units are the most economical, but on the other hand several small units, with a provision for idle or spare units, are safer. Breakdown of a large unit stops production altogether. Where small units are concerned, a single breakdown can be taken care of by an idle unit, while it would be financially impossible in most cases to provide a duplicate large unit as a reserve. Just what is done in this matter will depend somewhat on the part that power plays in the total cost of operations. In some cases, power and steam make up a large fraction of the total cost of production, and



then the most economical system of power and steam generation must be adopted. In other cases, power is a comparatively trifling proportion of total cost, and then it may be well to sacrifice something of economy in favor of safety from breakdown. Each case must be decided on its own merits.

**27. Expansible Power Plants.**—What has been said on the subject of expansible factories applies no less to the power plant. Probable expansion of the one implies probable expansion of the other. Consequently, power buildings should be so designed that additional units of all kinds can be added without disturbing the original layout of the power plant. The small unit system offers advantages in this connection. New units of similar size can be added concurrently with every enlargement of the productive departments. Shortage of power must be most positively guarded against, since it is an insidious failing that drags down efficiency in all departments, and disheartens everybody, because there is no possible remedy for the troubles it causes. A properly equipped power plant, of ample capacity, and arranged with due precautions as to possible breakdowns should therefore be a particular care of the executive who is planning a new industry.

**28. Running of Equipment Service.**—The equipment function includes not only the installation of equipment, but also the maintenance of the services provided. The equipment function includes the selection, installation, and running of all the physical equipment. By this is meant, in practical language, that the engineering department undertakes power supply, lighting, heating, fire service, etc.; also all maintenance and repair work. It keeps not only its own machinery in running order, but also that of the operation function, that is, the productive machines. The executive's relations to these duties will lie chiefly in the examination of reports and returns which will keep him informed as to the efficiency and cost of the work done by the engineering department.

**29. Plant at Work.**—The discussion so far has been regarding matters antecedent to actual production. Design has been discussed, and its influence on all later stages of work-

ing. Equipment has been considered, and the necessity of its proper arrangement or layout. The next step will be to consider how design is translated into actual goods, and how equipment begins to move, wheels to turn, and orders to be fulfilled. This study will include, first, a brief glance at the function of operation, whereby technical skill is applied to material, usually by the aid of machines; then will follow a review of orders as they set all activity in motion (function of control). It will further be necessary to consider how records and comparisons are made so as to insure that designs and orders have been properly fulfilled, and to ascertain what it has cost to do this (function of comparison). Finally must be considered the nature of the data to be put before the executive in order that he may be assured that everything is proceeding smoothly and efficiently.

#### OPERATION

**30. Function of Operation.**—Operation, whether by hand or by machine, is at all times a technical matter; that is, it involves the application of skill to material for the purpose of production. It is the function (along with that of design) that differentiates one kind of business from another. The principles of equipment, control, and comparison are common to all plants in greater or less degree. A shoe factory, a soap works, a typewriter plant, a textile mill, all employ similar principles in organizing these functions. But operation in these various plants is totally different. It involves different kinds of skill, and generally, though not necessarily, applies them to different kinds of material. Operation is trade skill and there is little more to be said about it.

**31. The Executive Viewpoint.**—From the executive viewpoint, however, one or two things of importance must be considered. In a given plant there are always a number of different kinds of skill necessary at different stages of production. These may correspond to different kinds of machines, or they may be forms of manual skill. If such skill can be made

fluid and transferable, it is a very good thing. Trade-union rules prevent this in many industries, but where it can be done, it is advantageous to train operatives to do two or three kinds of work so that they may be transferred from one operation to another as occasion demands, instead of being laid off. Another consideration is one of policy and should have been discussed, properly speaking, under the head of equipment, but as it has to do with skill it will perhaps be understood better at this stage. In some industries a choice exists between what may be termed *general* machines and *specialized* machines. A milling machine (in metal working) is an example of a general machine. The same type of machine, specially constructed for machining some one automobile or sewing-machine part *only*, is a specialized machine. The point is that a general machine will usually do all that a specialized machine of the same type can do, but not so economically. Which is to be installed? When is a specialized machine to be preferred to one of the general type?

**32. General or Specialized Machines.**—The answer to the question raised at the end of the preceding article is not easy to give, and, in fact, many catastrophes in the business world have arisen out of just such a problem. Hand operative skill can be changed rapidly, by the simple process of firing and hiring, but not so machines. They represent locked-up capital, and, if they cannot be kept at work, represent a dead loss. As a general principle, specialized machines should not be installed unless there is practical assurance that they can be kept working to their full capacity. This implies a continuous flow of business of precisely the kind that the machine will do. If there is doubt of this, then it will be better in most instances to set up a general machine to do the work, even though it may be less economical. The whole business, however, goes far back to the original question of design. The prospective manufacturer must know clearly what he is about. Then, having settled exactly what line of work is to be taken up, let him abide by that. Let him not seek or accept business for which the plant is not perfectly fitted.

**33. Operation the Only Money-Earning Function.** The executive will do well to get this fact well fixed in his mind: Money is made nowhere else than in the operative department. All the other functions, with all their array of buildings, machinery, experts, engineers, busy staffs, and constant expense, are simply the servants of operation. Themselves, they make no money, they only establish conditions under which operation may earn money by turning out salable product. The next thing for the executive to fix in his memory is the slogan *Keep the machines at work*. An idle machine is a missed opportunity. An idle machine is a constant reproach to the foreman, to the planning department, to the sales department, and, not least, to the executive. To which of these it is the worst reproach depends on why it is idle. It may be stopped for repair, or because no man is available, or because some cog has slipped in providing it with work that is available, or because there is no work for it. Each of these cases implies a reproach to a different individual, but a succession of such cases, a considerable percentage of idle machines from whatever causes arising, implies a reproach, and a grave one, to no one more than to the executive. This matter will be referred to again when considering the subject of reports for the executive. Few plants, except those organized on modern lines, have any true idea of the time lost in idleness by their machines.

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### CONTROL

**34. Function of Control.**—Having considered equipment and studied some of the principal aspects of the two technical functions—design and operation, the next thing to take up now is the problem of control; to show how, by virtue of control, the plans laid out by design are translated, through the efforts of operation, into finished product. And this leads at once to the subject of orders. Control is emphatically the function of orders. The plant is lifeless, as far as operation is concerned, until an order starts things up. But it will be

at once suggested that an order is a lifeless thing also. This is true. Therefore under the head of control must be considered not only the nature and routine of orders, but also the living factors who give out orders, handle them at every stage, and carry them out in detail. This is a matter of staff organization. It will be understood that a design and an order are two very different things. A design is merely a plan. It may exist without ever being carried out—no inconsiderable percentage of designs meet just that fate. But an order is, as it were, a definite push to start the wheels. It is an executive act, pure and simple, whereas a design is a technical proposal only. Design shows what is wanted. Orders set people and things in motion to carry out the plan indicated by the design.

**35. Layout Problems of Control.**—Just as layout is the fundamental basis of plant arrangement, so it will be found that successful control depends upon layout. In the first place there is the layout of staff relations, or, as it is often called, *staff organization*; and secondly, there is routing, or order control, which is in effect a layout of the path to be taken by material in its progress from the raw stage to finished goods. Both of these are big and complex subjects that can be presented here only in outline, from the side of most interest to the executive. This complexity is not found in equal degree in all types of plant, it is true. Some plants have hardly any staff organization and practically no routing, and this statement refers not merely to defectively organized plants. Some industries are so simple that they have absolutely no need of the complex organization that is justifiable and necessary in others. The first step here, will be, therefore, to discuss the conditions under which the simple and the complex type of organization, respectively, is called for.

**36. Simple and Complex Control Systems.**—The main object of a control system is to take care of orders, such orders representing salable product. The complexity of control will therefore depend in a great measure on the relation that orders bear to the output. In continuous industries, where product of a perfectly homogeneous character flows out

from the plant in a regular and uninterrupted stream, so that no one portion of it is any different from any other, the simplest conditions are presented. In such case there is practically only one order to handle. Individual customers' orders never get to the plant at all. The product is, as has been aptly said, "made by the mile in the plant, and cut into foot lengths in the stock room." The control system in such a plant will be very elementary. The opposite of this is found in those industries that work on a multitude of small individual customers' orders, no two of which are alike. A third case is that of a factory making things like typewriters, or other comparatively small mechanisms, where, though there may not be many ultimate patterns of product, there are a multitude of separate parts, hundreds of separate assemblies (that is, groups of parts fitted together), and a vast volume of intricate transactions, all of which have to be produced or carried out on an exact time schedule, so that they will meet together in unison.

**37. Small-Plant and Large-Plant Control Types.** The discussion of the preceding article is based on the supposition that the plant is one of considerable size. The control methods adapted to small plants will in general differ greatly from those appropriate for large plants. In the latter, functionalism, that is, the fine subdivision of duties, and their assignment to different individuals, can be carried out to full extent. In the small plant the scale of operations does not permit this. One man must perform several functions. While nearly all the attention of economists has been focused on the problems of the large plant, as a matter of fact only 2 per cent. of the factories of the United States employ more than 250 persons each. Upwards of 270,000 factories employ less than 250 persons, the average being 14 each. The small plant is, therefore, no inconsiderable factor in industry, and the type of its organization is important accordingly. The factory employing 100 persons or less is necessarily obliged to restrict its staff operations, because otherwise its overhead would eat up all its profits. A proper balance must be observed in this, as in all things, in planning the personnel.

**38. Small-Plant Organization.**—An average layout of staff arrangements in a small plant is represented diagrammatically in Fig. 7. The plant operations are managed by a superintendent who is directly in touch with the executive. All the business of the plant passes through his hands. Directly under him are his foremen and repair men, with probably a man in charge of stores, who may also take charge of finished goods and see to their despatch. No regular arrangements are made for transporting material or product. Perhaps there may be a laborer who does this work among other duties. The man who has just finished a job passes it along to the next

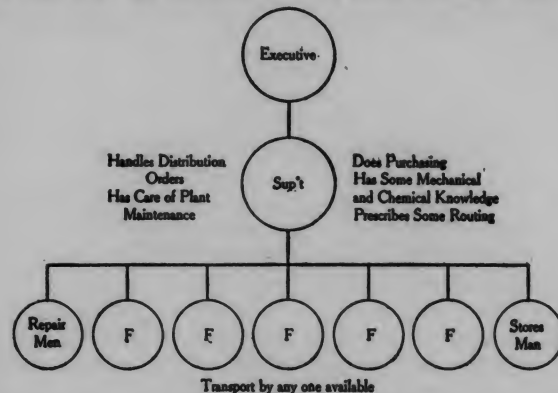


FIG. 7

man, or the man who is short of work looks around till he finds some ready for him. The superintendent is a busy man, full of detail. He receives customers' orders from the executive, arranges for the various components to be made by the foremen, sees to the ordering of material, makes a rough scheme of the order in which parts are to be turned out, and indicates some approximate time at which he expects them to be ready. He also sees to it that the equipment is kept in running order. Such a man has usually a good technical or trade knowledge, and he is a master of operation, but his knowledge runs in a narrow groove; he cannot branch off or strike out new lines

easily. Nevertheless, in a very small plant this state of affairs will often produce excellent results. Operations are all in sight. A few minutes spent in walking round the plant will put the executive and the superintendent in touch with the status of every order. No elaborate system is necessary.

**39. Providing for Future Conditions.**—As long as the plant remains small, the arrangement described in the preceding article will work well, provided energetic and reliable men are running it. But many businesses grow, sometimes rapidly. It is commonly the case that the same system is kept up for years with very little alteration, until some one dies or leaves. It may be that the executive sells out, or the superintendent goes; or the man leaving may be some one who is not officially entitled to such rank, but who is virtually the king-pin of that plant. Whoever the person may be, it frequently happens that one man's disappearance from the scene will bring up the plant's affairs with a jerk. If the plant has grown rapidly this may cause a severe setback, unless the opportunity is seized to reorganize on modern lines and functionalize the undertaking. But such action is hardly ever taken until it is forced by some untoward event that threatens the welfare of the business.

**40. Layout of Functionalized Staff Organization.** From what has been said on the diverse nature of operations in industrial plants, it will readily be inferred that there is no fundamental or obvious type of staff organization suited to all cases. Between the elementary small-plant type described and the organization of a plant employing several thousand people, there is a long range of intermediate types. There is no best type, though the contrary assertion is sometimes made. In Fig. 8 is illustrated an average type of plant staff organization. The affairs of the plant are under the control of a plant manager, who may be a vice-president of the company. Under his jurisdiction are the principal plant officers, namely, the superintendent (or superintendents) of operation, the purchasing agent, the storekeeper, the order and routing office, the plant engineer (in charge of equipment), and the chemist or other



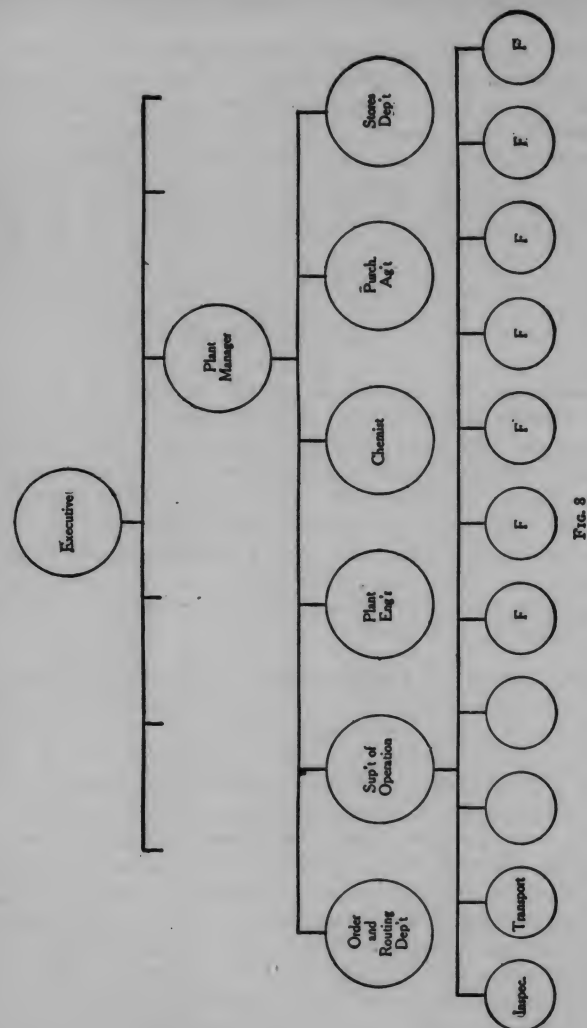


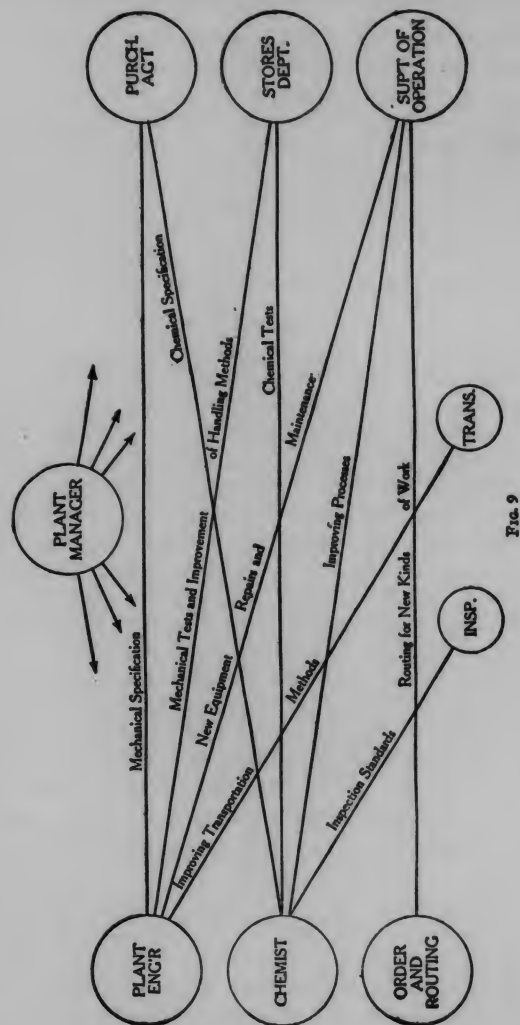
FIG. 8

technical expert. Under the superintendent are the various foremen, also the inspectors and the transport staff. It will be observed that the essential difference between this layout and that of the small plant is that the duties exercised by the superintendent have been decomposed or divided up and allotted to special men, namely, the care of orders to the order office; the care of equipment, including repairs, to the plant engineer; the care of purchases to the purchasing agent; the care of material to the storekeeper; the exercise of highly technical knowledge to the chemist or other expert.

**41. Devolution of Duties.**—The splitting up of functions and assignment of special duties to separate individuals is a typical process in the growth of a plant. It is called **devolution**. In a very small plant, say a blacksmith's shop, all the functions are exercised by one man. As the business grows he sheds duties one by one, till one day he is perhaps the president of a million-dollar corporation and all his routine duties are being performed by others. This process is very important to observe, because it is the true path of development in a growing organization. It can be applied in any type of business. But it must also be remembered that with every such devolution arrangements must be made for harmonious working. Therefore, in the instance illustrated, if the office of superintendent of operation is regarded as corresponding to that of superintendent in the small plant, then, in order to regulate the team work of the new officers, a plant manager is placed above all of them. His duty is to coordinate and harmonize their work so as to contribute to a good general result.

**42. Consultative Relations of Staff Organization.** In Fig. 9 are illustrated in diagrammatic form the relations of the group of officers shown in Fig. 8. The lines running across the diagram represent so many different functional exchanges between the men. They also represent the different lines of thought running in the small-plant superintendent's head, at any rate to an elementary degree, before the duties were devoluted on separate officers. From an examination of this diagram the reason why the small-plant type of organ-





ization must burst its bonds sooner or later will be understood. It is not necessary to go over the items of this diagram in detail, as they will be understood from an inspection. Each line represents a specific kind of consultation between officers. Thus, to take one case only, the superintendent consults with the plant engineer with regard to new equipment and to the upkeep of the existing equipment; with the chemist or other technical expert on the matter of improving processes of operation; with the order office on the question of routing new varieties of work. The examples shown are only typical, and not exhaustive. The details will naturally vary from plant to plant.

#### 43. The Executive and the Organization Layout.

In seeking to improve staff organization the executive will keep in mind the principles referred to in the foregoing articles. Though he may not be able to devolve each separate duty on a different man, unless the plant is a large one, yet it should be possible so to lay out the organization, that the appropriate combinations of duties are consolidated. Thus, purchasing and storekeeping may be under one head. The superintendent can also be the plant engineer. Chemical or special technical knowledge, being infrequently called for, may be supplied by the executive himself, if qualified. But careful watch should be kept to see that this doubling up of duties does not lead to one set of them being inadequately performed. A man who is forced to divide his attentions between two or more duties can hardly give the best service of which he is capable. For good results he needs to concentrate his attention. By relieving him of irksome and ill-advised duty, devolving it on another, improvement can often be brought about. Layout of organization is, in brief, fitting the jobs to the right men, so that the knowledge and experience of each is utilized to the maximum advantage. A clear idea of the functions to be performed will greatly assist in planning this.

**44. Control of Orders.**—After this survey of the way in which the duties of control are devolved on certain individuals, the next subject for consideration is that of orders. The whole object of a business organization is to push orders

through promptly, accurately, and effectively. It has already been noted that orders may form a complex or an exceedingly simple system. In a paper mill turning out only one kind of paper, there are no orders, or, theoretically speaking, there is one continuous order, lasting through a certain financial period, say a week, or a month. There is no routing to be done, since the operations have a fixed sequence, and cannot be varied in any way. The only orders are customers' orders, but these have nothing to do with the factory as such, since the product is the same for all customers. The only thing approaching an order would be an instruction to the factory to turn out product at a certain rate, assuming that it was not already working at full capacity. In such a plant most of the usual elements of control are wanting; there are no orders, no routing, no tracing, and no planning. It is impossible for production to get out of balance by the production of more of one component than will suffice to meet other components, for all processes work simultaneously and in sequence. Between this simple kind of industry and the most complex kind there is an enormous difference.

**45. Intermediate Type of Order Control.**—A printing plant presents an example of an industry dealing with large numbers of orders, though in no way representative of extreme complexity. Most printing consists of process work done on one kind of material. There is first the design, in the shape of the customers' copy. Material (paper) has to be provided either from stores or by special purchase. Type has to be set, by either hand or machine. The accuracy of the typesetting is first ascertained by proofreading (corresponding, in the general scheme of industry, to inspection); then the paper is issued from stores and the job is printed from the type. The sheets pass through cutting machines, and may be folded and stitched. The product is then passed to the stock room for delivery to the customer. Now, it will readily be seen that a number of undesirable accidents may happen to the order if precautions are not taken in advance. The wrong paper may be used, or the wrong type, or the wrong ink. The

paper may not be forthcoming when wanted. It may be printed on the wrong kind of machine, either wasting time or producing a poor result. It may be cut or folded wrong. It may be kept waiting too long for its turn at the press, or at the folding machine, and so on.

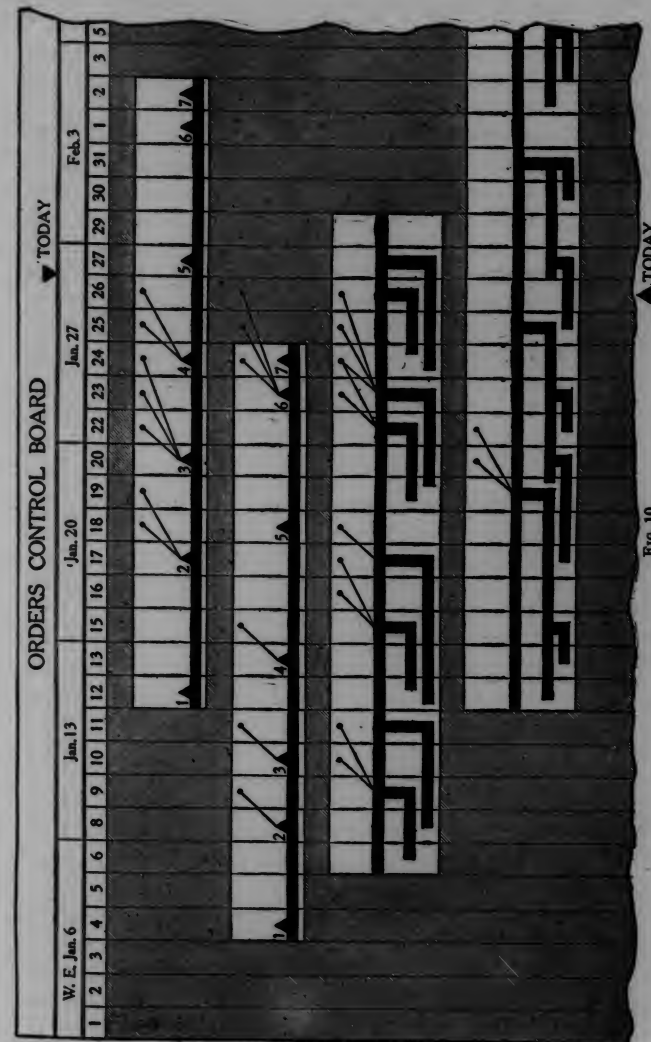
**46. Control as Regulator of Production.**—It is for the purpose of systematically preventing errors and accidents in the filling of orders that order control is instituted. In addition to this, control is also necessary so that it may be possible to know just how far any particular order is advanced toward completion. Paper-mill control, which has been referred to as an example, is simple, because of the relative absence of opportunities for misadventures to an order. In proportion as such opportunities become more numerous, a more extended system of control becomes necessary. As soon, however, as all misadventures and accidents are duly guarded against, any further control is worse than valueless; it becomes mere red tape. The executive should bear this in mind as a touchstone for proposed innovations. The maximum complexity in control is reached in plants where the final product is made up of a large number of parts that arrive at the final assembly not singly, but already combined in numerous sub-assemblies. A typical example of this kind is seen in automobile manufacture. Some parts are here made in enormous quantities; some are purchased; partially assembled combinations are made and held in large numbers in stores; while some parts are almost individual to one specific order. If misadventures may occur in a printing plant by the dozen, in an assembling industry of the extreme type they can happen by the thousand. Consequently, in such industries control is being reduced to a science. The whole plant tends to move like a well-regulated clock.

**47. Principal Items to Be Controlled.**—To insure the putting through of an order without mishap, the following things usually have to be considered: (a) The design, which may be, for example, a customer's order for linotype printing, with *copy* and specimens of type and paper wanted; (b) the

material, which must be ordered from the storeroom for issue at a given date; (c) a time-schedule must be worked out showing each stage of the order and the date at which it should be completed; (d) provision must be made that the machines will be free to do the work within the times respectively specified; (e) the quantity to be printed must be specified, with margins for spoilage; (f) the ink, if special, must be treated by the same routine as the paper; (g) mechanism must be set up to insure that the progress of the order at each stage is registered in the control office, and is not allowed to fall behind time; (h) the printing and other machines to be used on the order must sometimes be indicated. The methods by which these various points are controlled will now be considered in detail, so as to suggest the general idea on which each is founded.

**48. Time Schedules.**—The various operations on the order must not only be performed in a certain sequence, but each of them should be completed by a certain time, if delay is to be avoided. Fig. 10 shows a diagrammatic representation of an elementary form of control board, by the aid of which the different steps on orders are coordinated. The control sheet is divided by vertical columns into day spaces. On this sheet are pinned slips of card, each representing an order. The cards bear marks that represent definite steps to be completed by definite dates. Thus, the two upper cards may represent orders passing through a printery. The left-hand edge of each card represents the date at which the order was received, say Jan. 12. The marks numbered 2, 3, 4, 5, and 6 may represent steps. The right-hand edge indicates the date of delivery, namely, Feb. 2. The steps indicated by the numbers may be these: 2, linotype room; 3, into press room; 4, into folding room; 5, into bindery; 6, into packing room; 7, delivery to transportation company.

**49. Control of Delay.**—As indicated on the board, the first order should enter the linotype room by the 17th, the press room by the 20th, the folding room by the 24th, the bindery by the 27th, and the packing room by the first of



February. It is assumed that today is January 26. Whenever an order passes from one department to another a report to the control office is made, and in the absence of such a report it is assumed that progress has not been made. Each night, therefore, the delays to date are marked against each order, by drawing lines from the date due to the actual date. Thus, the order due in the linotype room on January 17, was not reported on the 18th, so a line was drawn. On the 19th it was still unreported, so another line was made. On the 20th it was reported, so no further annotation was necessary. Similarly, the record shows a delay of three days in passing from press room, No. 3, to folding room, No. 4. Up to the present the first order is two days overdue in passing from No. 4 to No. 5. In the same way, the second order, which was due to be delivered to the railroad on 24th, is three days behind schedule in the packing room.

**50. Reading Control Board.**—All the information carried by the control board is taken in by the eye at a glance in much shorter time than it takes to describe it. An order cannot get much behind before the fact is observed, and the board indicates precisely in which department the delay is occurring. A few nearly vertical lines will not signify much, but as soon as any line gets to be long and tends toward the horizontal, the eye singles it out for attention. In practice, the control office will investigate all delays as soon as they appear to threaten non-fulfilment of the delivery promise. Each day something will probably occur calling for investigation, but whether there is a reasonable explanation or not, an order that is much behind cannot fail to attract and retain attention.

**51. Informing the Customer.**—Another important function of the control board is in making it possible to give reasonably accurate information to the customer, when he inquires as to the probable time of delivery, or wishes an order to be expedited. The exact stage of the order is ascertainable in a moment from the board. Familiarity with the run of business will enable the control office to estimate a date for

delivery, if it is possible to expedite the order. Thus guesswork is avoided, and the fatal defect in a badly organized business—putting the customer off with a wild promise that will most probably not be kept—is rendered unnecessary.

**52. More Complex Type of Control Board.**—The lower half of Fig. 10 illustrates in a very elementary way the principle of control as applied to industries in which components are assembled in groups and join the main order at different stages. Thus, to take the third card from the top, it will be seen that the order was started on the 6th, and that components were due to start on the 6th, 8th, 12th, 19th, and 24th. These components should be ready to enter the main order on the 9th, 11th, 15th, 17th, 22d, 23d, 26th, and 27th, respectively. As shown by the black pins and inclined lines above the main black line, each of these orders has been subject to some delay. The item due on January 23 is most seriously affected, being three days behind. In the order on the lowest card, a triple series is shown. In this case the articles made, represented by the lowest lines, do not enter the main product, but are themselves absorbed into other sub-assemblies, which join the main stream later. More complex relations than these can be shown in similar manner when the work demands it. In the case of a large machine, containing many parts, the control would demand a large board apportioned to that order alone. In such cases the control sheets can be hung on swing boards, and the order of the leaves will represent the dates at which each order is deliverable.

**53. Difference Between Planning and Control Board System.**—In Art. 47, wherein some of the principal items to be controlled were enumerated, the following, among others, were noted: (*d*) Provision must be made that the machines will be free to do the work within the times respectively specified; (*h*) the printing and other machines to be used on the order must sometimes be indicated.

The method of control shown so far has not taken these requirements into account. It merely records what has happened, and compares actual happenings with what was



expected, but it does not in any way plan the results. Although planning usually includes control, the reverse is not the case. Control boards are independent of planning, and may precede it; that is, the installation of an effective system of control boards may suggest the necessity of planning. The main feature of planning is a careful study of the capacity of machines, followed by the dissection of each order so as to find the demand made by it on the different kinds of machine capacity available. Thus, a printing machine of a certain type may have an output of 25,000 sheets of a certain size in a working day. This is its *load*. If then each order is dissected as it comes in, and its requirements are allotted to definite machines, there will result a series of figures representing the loading of each machine, as far as that day's orders are concerned.

**54. Ascertaining Machine Loading.**—If a machine will do only one thing, in one way, at one speed, it is a very simple matter to ascertain its hourly load. Thus, a platen press may turn out 30,000 copies per day of 10 hours, and this gives an hourly loading capacity of 3,000 copies. If there is assignable to that press an order calling for 15,000 copies, it is evident that the machine will be loaded to its full capacity for 5 hours. If the morning mail brings twenty orders, which on dissection are assignable to that press, and aggregating 90,000 copies, then that machine will be booked for three days', or 30 hours', work ahead. If, however, there are two such machines, then a loading of 15 hours may be assigned to each, or 20 hours to one and 10 hours to another, according to the urgency of particular orders. This is the general principle of machine loading, but not many cases are as simple as this. The speed of working may vary according to the nature of the work, even in so standard an operation as printing. In dyeing cloth, hardly any two fabrics are worked at the same rate of speed. In machine work, not only does the speed vary with the condition of the metal being worked on, but the time occupied in setting up and holding the piece will vary within wide limits. It will be seen, therefore, that the

ascertaining of load requires thorough technical knowledge of what the machine will do under varying circumstances.

**55. Control of Subsidiary Activities.**—In many cases, and especially in machine work, order control embraces other things than machine loading and delivery of material. It happens not infrequently that an order cannot be set in motion without certain auxiliaries, and the control office has the task of seeing that these are specified and provided at the proper times. Thus, in foundries nothing can be done until the proper pattern is provided. In machine shops, special jobs require special sizes of drills, taps, reamers, and so forth; and in many cases jigs or holders of special shape are necessary before the job can be placed in position on the machine. All these subsidiary appliances are kept in tool rooms, and the control office has to issue its instructions in such a way that the requisite tools meet the job at the right moment in the right place. Lists of all the tools, jigs, formers, etc. required for the job are prepared and sent to the tool-room foreman, who is then responsible for getting them ready by the time they are required. In some cases certain appliances, in frequent use, but of which the supply is limited, may have to be assigned a definite load, just like a machine, to insure that they will be at hand, and free, when required for a particular job. This is, however, an unusual condition.

**56. Control of Material.**—In a preceding article it was noted that provision must be made that paper and ink, for example, of the proper quantity and quality, shall be on hand when required. This is secured by cooperation between the order office and the storekeeper. The stores ledgers show the current balances on hand, and provision is commonly made for earmarking or allocating free balances to the use of particular orders. Consequently, the instructions to the storekeeper to have material ready for delivery to the plant at a particular date are very easily met. In most cases it is well to provide a mark on the order control board slip to show this date. If the material is not in stock, but has to be specially procured, this fact should certainly be noted on the



order slip. In such a case it is probable that the dates for the series of operations will be uncertain until the material is either on the way or actually received. Orders waiting for material in this way should be placed on a separate control board until it is possible to fix dates in the usual routine. In complex situations the same principle is applied in much the same way, only the number of transactions is vastly greater, and consequently great care is required to insure that nothing, however small, has been omitted. Otherwise, the whole of an important order may be brought to a standstill.

**57. Controlling Machine Loading.**—Assuming that the analysis of loading capacity and dissection and allotment of orders are made with reasonable correctness, it is obvious that by setting up an account for each machine, and charging against it all orders at their hour-load rating, and crediting it with all orders already finished, also at the hour-load rating of each, a balance is obtained that represents at any moment the extent to which the time of that machine is going to be taken up in the immediate future. This information is used in fixing the marks on the card slips pinned on the control board, as discussed in earlier articles and illustrated in Fig. 10. If there is on hand an order for a certain press, and that press is loaded up for 30 hours' work ahead, it evidently cannot begin the job for three days from date. It is, therefore, useless to assign an earlier date for the arrival of this order at the press room. By dissecting all orders in this way, settling the sequence in which they are to pass the machines, allotting due dates accordingly, and recording movements by means of the control board, a very satisfactory control over orders can be secured at a comparatively small expense. The same principle is applied to assembled orders, but the application becomes more complex just as the detail to be controlled becomes more intricate. It may be said, however, that the importance of control in such case increases even more rapidly than the complexity.

**58. Summary of Control Function.**—The principal limits of the function of control have now been explored.

There is, first of all, the fundamental framework, in the systematizing of the relations of the plant personnel. In the second place, orders set in motion the activities of the plant in a previously determined sequence and on a previously determined time schedule. By analyzing the capacity of the machines to turn out work, an hourly load rating can be set up, and by dissecting orders as they come in, the work can be so allotted that a reasonable estimate can be made of the probable time at which any given order will reach its various stages of completion and its delivery. All control, however complex and involved owing to the intricate detail of the work to be performed, rests on the general principles observed in the foregoing articles. It will readily be understood that the executive who compares his current practice in the light of these principles will be able to locate any maladjustment that he finds in his own plant. Control is the function which deals with orders and with those who give them out. Delays, errors, and broken promises of delivery are all due to faulty organization of control. Each of the devices described answers a particular question, and when all these questions are correctly answered, there is little excuse for a high average of either delays, errors, or broken promises. Individual cases will always have their special explanations. It is the average that the executive must regard.

#### COMPARISON

**59. Function of Comparison.**—Comparison is described as that function which measures, verifies, and records; or, in other words, it is the watching function. It will at once be realized that, with one exception, presently to be discussed, no other function yet considered has anything to do with either measurement, verification, or record. It has been pointed out in earlier articles that design provided the operative machines, while equipment established them and, by means of orders, set them going, together with the general plant activities. But nothing has, as yet, been said regarding the recording of all these activities, with the single exception

that a method has been described for representing, on the control board, the movement of orders. It may be admitted at once that this step, properly speaking, forms part of the comparison function, but was included, for convenience, under the description of control. In a general way, comparison is the function that takes accomplished facts and examines whether they accord with intentions. It has two main divisions, the one, *inspection*, dealing with physical material, and the other, *accounting*, dealing with quantities and values.

**60. Inspection.**—When considering the function of design it was stated that design implies tests or standards of performance that should be applied to insure that design has been effectively carried out. In many cases this question of tests has a double aspect. In building any kind of mechanism, the design will first of all indicate certain tests to be applied to each part or component manufactured. Thus, a piece of metal must be finished to exact dimensions measured in thousandths of an inch; or, it may have to pass *limit gauges*, which are a kind of fixed and very accurate calipers, one gauge guarding the high limit of permissible size and the other the low limit. The difference between these two limits is termed the *tolerance* permissible in the article measured. But when all the various parts have thus been made very accurately, and assembled into the complete machine, another series of tests comes into play, namely, tests made to determine whether the machine as a whole works perfectly. Most assembling industries have this twofold series of tests, but in some industries the tests applied as the work goes along are sufficient. The act of applying tests to work in process is called *inspection*. The examination of the working of a completed machine is usually referred to as *testing*.

**61. Inspection in Relation to Order Control.**—It will be remembered that movements on the order control board are carried out according to reports received from the plant as to completion of each stage of the work. Where inspection is systematized, these reports are made by the inspectors. As each batch of work passes them, they send a report to the

order office giving the order number and the number of pieces that have passed inspection. By this means the order office knows exactly the condition of the order and whether spoilage or imperfect work will make it necessary to put a new supplementary order in hand to make up the full quantity called for by the customer. In some trades, however, as in making screw parts to order, it is usual for the contract to be drawn so that the customer accepts whatever quantity, within reasonable limits, survives the inspection. In printing, a larger number of sheets are put into process than are called for, the excess being the subject of regular tables showing the standard excess for an order of a given size. In cloth finishing, the plant contracts to turn out an exact number of yards from a given length of "gray" cloth, taking the risk of having to pay for shortage, but on the other hand keeping possession of any surplus that may result. Whatever the trade customs may be, it is evidently important that the order office shall know exactly what is happening as the goods pass each inspection station.

**62. Diverse Character of Inspecting Operations.** It will be seen from the foregoing article, that inspection demands technical knowledge. Although the tests to be applied are often specified in great detail or with great exactness by the department of design, still, in many cases, judgment is necessary. Where inspection is absolute, as in the case of limit gauges, then skill is not required because the skill has been transferred to an apparatus. Unskilled help, sufficiently intelligent, however, to be entrusted with high-class and easily damaged appliances, can be taught to apply a limit gauge to each piece as it comes by, since there is no leeway for error; a piece either will pass or will not pass. But in many industries it is not feasible to apply so simple and definite a test as this. In chemical industries, laboratory tests requiring very special training are often necessary. In such trades as printing or dyeing, the matching of colors and the obtaining of special effects demand special aptitude and familiarity with those classes of work. The planning of suitable tests is a very

important matter. The automobile industry, for example, could not exist in its present extent, were it not for the fact that enforcement of mechanical precision has been reduced, by means of limit gauges, to a series of simple inspections. In proportion as simple, exact, inspection tests can be introduced into a business, its prospects of making money increase.

**63. Importance of Inspection.**—Inspection compares the results of operation with the intention of design. Consequently, it should be applied as frequently as is economically possible. In its absence it not infrequently happens that product becomes faulty early in its career, but is, notwithstanding, put through process after process until the final discovery that it is disqualified. By this time much expense has been absorbed by it, all of which is a dead loss. Therefore, it is easy to see why, in many industries, frequent inspection is found to pay. In seeking to apply inspection, the executive should examine the course of his work and mark the opportunities for errors and miscarriage. Then inspection should be introduced at important stages, and gradually extended as found advisable. It is much better to begin at some important stage of production than to set up inspection stations indiscriminately, without experience of their necessity. All innovations in this direction should be introduced only in answer to some shortcoming that is definitely felt or known. Then their value is likely to be permanent. But before proceeding to set up inspection stations, the standards that they are to enforce must be accurately established, and if possible reduced to writing, so that there may be no dispute as to the justice of the inspector's decision.

**64. Time and Money.**—Whereas inspection is essentially a comparison of physical characteristics, as actually produced, with those intended and specified by design, *accounting* deals with an altogether different class of facts, namely, the measurement, verification, and record of quantities and values. In other words, its principal duties have reference to time and money. Of all functions so far dealt with, accounting is nearest to the executive, inasmuch as he depends on it for infor-

mation as to the state of affairs in his business. The main divisions of accounting are cost accounting (including time-keeping) and statistics.

**65. Costs.**—The subject of cost accounting has an extensive professional literature of its own. Nothing but the briefest outline of its function can be given here. But it will be advantageous to point out certain aspects of the subject that are of special interest and importance to the executive, and that are of a broad scope, so that they hold good independently of the particular system of cost accounting employed or the particular industry to which such system is applied. In recent times, great progress has been made in the methods of cost accounting, but the general underlying principles are often not clearly grasped by the executive, although these principles are in themselves simple enough.

**66. Variation in Complexity of Cost Accounting.** Just as was seen in the case of order control, and for much the same reasons, cost accounting is developed in very varying degree in different industries. In the case of a simple homogeneous plant, such as a paper mill making only one kind of paper, cost accounting is confined to taking account of all expenditure in the plant and dividing this by the yardage, weight, or other suitable dimension of the product over a selected period, say a month. The opposite case is that of an industry where parts are made in quantity, assembled and sub-assembled, made and purchased, held part-finished in stores, and so on. In such case, a complex condition requires a corresponding development of the cost system. Between these extremes all gradations occur in practice. It will thus be seen that there is no such thing as a universal cost system. Even for different plants in the same industry, local conditions may dictate a very different system. Every cost system needs to be specially fitted to the work it has to do. Although this is so in all cases, yet it is possible to indicate the main lines on which any cost system must operate, as all such systems have the same object in view, though they attain it in quite different ways.

**67. Principal Object of Cost Accounting.**—On reflecting over the course of work in a factory, with a view to determining just what must be known about costs, it will soon be evident that the viewpoint obtained will be affected by the nature of orders passing through the various processes. Between orders and costs there is an obvious connection, and this relation holds whether the order is an individual customer's order, or whether it is a manufacturing order for say a thousand articles to be delivered into the finished-stock room. The product may pass through, say, five departments, with a different process in each. The cost of departmental work on each order may with advantage be kept separate, so that the accounts will show what the work in each department contributes to the total cost. Again, it will commonly be observed that some departments are less fully occupied than others, some having idle machines and capacity in excess of demand at the moment. This suggests that it might be well to separate the cost of actually doing work from the expense incurred in maintaining idle equipment. In this way, going over the whole field of activity step by step, a good idea may be gained of the sphere of cost accounting in a manufacturing plant.

**68. Division of Cost into Production Factors.**—If it has been decided that the departmental cost of orders is what is wanted, the next step is to consider the separate items that go to make up the total. From what has already been said about production functions, it will be readily understood that while cost of labor employed in actual operation is a direct cost, and can be measured as and when applied to each order, this is not true as regards the cost of design, or of equipment, or of control, or of the comparison function itself. The expenditure on these functions has no relation to any particular order. In other words, it is what is called *indirect*, or *overhead*, *expense*. It is also frequently referred to as *burden* or *expense burden*. The collection of all such expense is best made according to a classification customary in cost accounting, the several items being grouped under certain heads known as *production factors*.

**69. Enumeration of Production Factors.**—The first of the production factors is the *lands-buildings factor*, sometimes called the *space factor*. Under this head are collected all the costs of maintaining the plant in a condition ready for work, that is, heated, lighted, fire-protected, etc. Much of the cost of equipment falls under this head, which includes a rent charge for buildings and premises.

**70.** Next comes the *power factor*, which sums up the expense of the power department and reduces it to a charge per horsepower hour. Next again is the *stores-transport factor*, which collects the cost of purchasing, storekeeping, and transporting materials. The cost of *supervision* forms a fourth factor. A fifth factor embraces the cost of the *organization*, cost keeping, order control, timekeeping, etc. Finally, there is a *machinery factor*, which represents the cost of maintaining and running the operation machines only and therefore covers the ground of the operation function. The first step in cost accounting is to determine the incidence of each of these factors on the department under discussion, that is to say, the share chargeable against the department for the services represented by each of the factors.

**71. Departmental Costs.**—There will thus be a series of charges against the department, one for each factor, and also charges for the direct labor and the direct material used on orders. Out of these elements cost is made up. The allowance for direct labor and direct material is very straightforward. They are simply charged to the order on which they were expended. There then remain the production factor charges. How shall they be distributed? The simplest case, and the only one that can be discussed here, is that in which the department consists of a number of machines all alike, say twenty machines. Then the charge for space, for power, for stores-transport, for supervision, and for organization are added together. The individual machinery charges can also be added into this total, as they are all alike. The sum total of these additions is then divided by the working hours of the department, say 20 machines at 240 hours per month, making



4,800 working hours. There is thus obtained an hourly rate for each machine. This hourly rate is then added to the cost of direct labor and direct material, to form departmental cost of operation. Now if for any reason the department does not run full time, all the expense will not be transferred to orders by the hourly rate, since some machines will be idle. The amount of this unabsorbed burden is a very important index to the efficiency of the department. If it is high or tends to increase, it must be explained by lack of work, or else by failure to keep machines employed as they should be. Anyway, it indicates an unsatisfactory condition and is a *prima-facie* case for inquiry.

**72. Reason for Separating Idle Time from Used Time.**—At the end of a slack month, there will have been so much of the total burden charged to orders by means of the hourly rate for the use of machines, and so much will not be charged anywhere. It is unabsorbed. In a very busy time when the shop is running full of work, every machine will be working at a maximum and little or no expense will fail of distribution to orders. The costs so obtained in the busy time are the *true* working cost of the department. Now if there is a slack period and half the machines are idle, the expense may be no less or little less, but only half the work is done and consequently it is, from one point of view, costing twice as much as before. But this increased cost cannot be recovered from the customer. It is therefore of no service for estimating or bidding on new business. By the device of the hourly rate, however, the order costs, officially, that is, on the books, no more in slack than in busy times, other things being equal. But the unabsorbed burden is much greater. This unabsorbed burden, however it is regarded, must be charged to profit and loss account. There is no one who can be made to pay for it. It is therefore better to keep this unabsorbed burden entirely separate from true cost. This is just what is done by establishing for the use of machines an hourly rate independent of the state of trade. The method must be used with caution, but when so used has important advantages.

### RELATIONS OF THE EXECUTIVE WITH THE FACTORY

**73. Statistics.**—Though plant statistics are part of the function of comparison, they will be considered here more particularly from the executive viewpoint. In many cases the executive does not concern himself very closely with the details of plant management. Frequently the main offices of a business are located in a city, while the plant may be from ten to a thousand miles away. In these circumstances the executive must rely on statistical reports to keep himself in touch with what is going on in the plant, or rather to make sure that nothing is going on which requires his personal attention.

**74. Viewpoint of the Executive.**—There are two main points on which the attention of the executive should be fixed: (a) The output, that is, the quantity of work turned out; (b) the factory expenditure. The relation between these two amounts represents the factory efficiency, in a broad sense. Where the product is one that can readily be reduced to units, such as yards, tons, cubic feet, etc., per week, the ratio of expenditure to output forms a very satisfactory control figure, even if, as is frequently the case, the product varies in character and has therefore a slightly different unit cost at different times. But it is not always or often that such a simple ratio can be established. A factory may handle several diverse lines of product, in which the ratio of cost to unit weight or length varies considerably. In most cases, therefore, the executive must be prepared to survey the transactions of the plant in greater detail.

**75. Reports for the Executive.**—A statement of finished output is obviously the first report which the executive will require. No explanation is necessary as to this. Next in order will be a more or less detailed analysis of factory expenditure, which should be drawn up so that the expenditure in each department is shown separately, and also combined into a general total. Fig. 11 shows a typical arrangement of a report of this character. The burden items for each depart-



ment are first shown separately and then as a total. Next direct labor and direct material are added, and totaled to show total departmental cost. Cross-totals of each item show total factory expenditure in each case. Below, the amounts of burden absorbed by orders, and not absorbed, are given, with the ratio or percentage in each case. It is open to the executive to have the detail shown on this report expanded to any degree he deems necessary. The principal items of expense that make up the factors may be detailed. Direct material

FACTORY EXPENDITURE			WEEK	ENDING	
Item	Dep't A	Dep't B		Dep't F	All Dep'ts
Space Factor					
Power Factor					
Stores Transport Factor					
Supervision Factor					
Organization Factor					
Machinery Factor					
Total Burden					
Direct Labor					
Direct Material					
Total Cost					
			Utilized and Unabsorbed	Burden	
Utilized on Order					
Unabsorbed					
%					

FIG. 11

and direct labor may be shown by classes of product, if there is more than one such class. The report will be accompanied by another showing the output, by classes or otherwise as the case may require. By comparing one month or week with another, and noting increases or decreases in any of the items, the executive will be able to keep fairly close control over the essential economy of the factory, without losing himself in detail. It is assumed that the factory is under a thoroughly competent plant manager, so that only a general survey of the situation is necessary.

## EXERCISES

- (1) Explain the meaning and use of the third slip from the top shown on the control board illustrated by Fig. 10. Your explanation should cover all items shown on that slip.
- (2) Why is it important that inspection be made, at reasonably frequent intervals, of material passing through a complex series of manufacturing operations?
- (3) Discuss the relative advantages and disadvantages of the group or departmental arrangement and the straight-line arrangement of machinery.
- (4) Discuss the relative advantages of large and of small units for the power plant.
- (5) (a) What is meant by the general type of machine and by the specialized type? (b) Discuss their relative advantages and disadvantages.
- (6) Is the radial type of building to be recommended for factory use? State the reasons for your answer.
- (7) Indicate how the order control board serves, among other things, in responding to inquiries and complaints from customers.
- (8) What is meant by *unabsorbed burden* in computing costs of production involving an item for machine work?
- (9) In many processes there is a certain amount of spoilage. Explain this term and mention several different types of contract regulating the manner in which spoilage is allowed for.
- (10) What part does the order control office play in providing for the tools required on a given job?

## CHAPTER VI

### MARKETING THE PRODUCT

#### INTRODUCTORY

**1. Range of the Discussion.**—In this Section will be considered the series of operations by which business is sought and obtained. These operations cover *publicity* and *advertising*, the first line of approach to the public; *estimating*, which is price making based on previous cost records; and *selling*, which must here be understood in a broad sense as including personal approach to the prospective customer and also the entire organization and mechanism of a sales department.

The viewpoint to be adopted in the present discussion will be mainly that of the executive in his relation to the problem of cultivating and securing new business.

**2. Modern Development of Selling Methods.**—The routine and practice of business-getting has undergone considerable development in recent years. A great deal of inquiry has been devoted to the examination of the fundamental principles that underlie the processes of announcement and persuasion. The psychological aspect of sales promotion has been studied extensively, and the study of sales possibilities, the planning of sales campaigns, the organization of cooperation or teamwork between the different functions represented in a selling department, have all been developed into a very valuable body of standard practice that greatly assists in the direction of economically sound sales promotion. Such practice, if

carefully adhered to, will prevent rash and wasteful attempts to create business by lavish expenditure in ways and in quarters where the returns could not possibly be adequate, even under the most favorable circumstances. In recent years, too, much specialization has developed in this field. The designing and writing of advertisements, booklets, and campaign literature generally, is largely in the hands of experts trained to pick out just the salient points for propaganda that will appeal to the public. These experts can do more effective work than the average firm can do for itself. It cannot be said that any crystallization of selling principles is as yet in sight. The subject has been developed empirically and is not yet reduced to a coherent system, but from a practical point of view the surface of the subject has been mapped out into several independent areas, and the practical executive needs to understand these main divisions in order to exert effective control over their activities.

**3. Main Divisions of the Subject.**—In approaching the systematic study of marketing wares, it will be convenient to consider the subject as divided into three main topics: (a) the *product* to be sold; (b) the *field* of prospective purchasers; and (c) the *propaganda*, which term may be taken to cover a variety of activities included under the head of sales promotion. Much more attention is being given today to the first two of these divisions than formerly. The product is not taken for granted. It is studied from many angles to insure that it is being offered in the most merchantable form. The prospective customers are studied with equal care. It is not sufficient to know that such customers exist; a survey must be made to ascertain their probable number, their geographical diffusion, their total purchasing power, and the extent to which they are being subjected to the influence of rival or competitive sales propaganda. Having determined the elements of the situation as regards product and field, it is then necessary to draft a scheme of organization for a sales promotion department that will exert the right influence in the right quarters and at the right time on the prospective customers.

**4. Sales Promotion Activities.**—Of the three main topics mentioned in the preceding article, sales promotion is the most complex. A study of this topic must cover a number of items, representing so many different influences brought to bear, each of which must be suitably adapted to the general plan of operations. Thus, sales promotion includes *advertising*, which may be either national in scope, or confined to trade papers, or to local and sectional organs; *mail solicitation*, in which the field is addressed by means of form letters and other communications; the use of *printed matter*, which may consist of catalogs, price lists, bulletins, house organs, or simple advertising leaflets and booklets; *salesmen*, or traveling men, whose function need not be enlarged on; *demonstrations*, either at stores or at branch offices, or in the customer's own office or plant; *distribution of samples*, a method obviously confined to certain varieties of product. A sales promotion campaign is not restricted to the use of any one of these expedients. More commonly it will embrace the use of all or nearly all of them. The importance, therefore, of coordination and cooperation in these very different varieties of sales activity hardly needs demonstration. A sales campaign is, in many ways, much like a military expedition. The general in command must know how and when to use cavalry, artillery, mines, airships, and so forth, and must know how to gauge the psychological moment for maneuver and for attack. So, also, salesmanship depends largely on the exploitation of the psychological moment.

#### THE PRODUCT AND THE FIELD

**5. Idea Behind the Product.**—The term *product* embraces an almost infinite variety of things, from battleships to tin cans, and from hand-made articles to goods produced by the ton or the mile and sold in carload or even shipload lots. Very little thought will serve to show that among such different kinds of product there must be enormous differences in the way in which they are sold. In point of fact, almost every individual product requires a sales promotion method specifically suited to it. In deciding on the best method, the first step is

to survey the peculiarities of the product to be sold. A number of questions arise: What is to be marketed, a *thing*, or an *idea*? It should be observed that in selling a piece of heavy machinery, for example, what is sold is really an idea. In the same way a breakfast food may be merely a cheap cereal put up in an expensive, though attractive, way; what is being sold, in such a case, is an idea, the idea of so preparing a food that it will have an appeal to the average man or woman. It is impossible to go very far into the analysis of motivation in buying, without finding that in the majority of cases it is an idea that is being sold rather than a concrete thing. The first thing to do, therefore, is to regard the product from this angle, and ask, What is the salable idea embodied in it?

**6. Appearance of the Product.**—An attractive appearance of the product is a more powerful aid to selling than might perhaps be expected on casual reflection, and this is true even of some goods in which appearance may seem of altogether secondary importance. The manufacturer will therefore profitably keep before his mind the question, How can the appearance of the goods be improved? In dealing with this question it must always be remembered that it is appearance to the purchaser that counts. Even in machines, some attention should be given to appearance. What parts should be painted or enameled, which should be bright, whether or not a stand is desirable—these are points that should be settled before offering the product. In other cases, the importance of a pleasing exterior is more obvious. Where goods are made into packets, the shape, color, and labeling assume great importance. Often, as in a certain brand of chewing gum, good talking points are extracted from some particular method of wrapping. In such a case, once more, it is an idea that is being sold. In goods sold against specification the mere appearance of the article becomes less important, though even here, between articles exactly alike, preference may be given by the buyer to one that is conveniently packeted, or put up in containers that are easily opened and handled. This, however, is not so much a matter of appearance, as of convenience.

**7. Containers and Packing Methods.**—The question of containers has another aspect. The extraordinary complexity of freight classifications makes the choice of containers one directly related to expenditure. A study of the matter by a man thoroughly versed in such classifications will often lead to the discovery that by the substitution of one kind of container for another, or by subdividing the shipment (as in the case of machinery and its accessory shafts and pulleys) considerable savings can be effected, by permitting the shipment or part of it to qualify for a lower classification, and therefore to benefit by a lower freight rate. Many points must be considered in selecting the mode of packing and the type of container. Ease of packing and loading, perhaps with the use of automatic machinery; the saving of space in shipment; convenience of handling into and out of the car and into and out of the customer's storage; the residual value of the container, and its possible return to and reuse by the manufacturer—such are some of the things that must be duly weighed in organizing the methods and types of packing employed. There is no royal road to success in this matter, no one solution for all problems that arise; in each case the situation must be surveyed, looking at it from all the angles indicated.

**8. Some Reasons for Failure.**—It will now be seen how it may come about that an apparently excellent product, in the manufacture of which great care has been expended, nevertheless fails to take hold on the market. It is not enough to have a good product. Very few products have advantages so evident that they make their own way by sheer excellence. It is, more particularly, not enough for the maker to know that he has a good product. He must have a clear view of the definite idea that it represents. Then, the product must be prepared for marketing in such a manner that all the auxiliary advantages that can be devised are added to its original claims for attention. Neglect of these points may not bar success, but will certainly make success come more slowly. Rough or careless finish or packing, though it may

not really diminish the ultimate value to the user, will surely predispose the buyer against the article. In most cases attention to the points just mentioned costs very little more than the time given to the discussion. The actual carrying out of good finish and good packing will probably cost no more than inferior work, once proper arrangements are made.

**9. Surveying the Field of Operations.**—All possible points having been settled with regard to the product, the next step is to consider the nature of the available field of sale. It is not uncommon for enthusiasm generated by some improved machine or appliance to cause the maker to rush in with intensive work in advertising, calling on prospective buyers, and so forth, only to find that the field in which it is possible to get business is so restricted as not to warrant anything like the expenditure incurred. An instance of this kind may be cited. A certain firm making an apparatus of very restricted application, yet involving a large investment, had a very costly catalog of some hundreds of pages. It was proposed to translate this into Spanish and distribute it among users in Spanish America. It seemed desirable, however, to make sure of the possible field first. This was done. It was found that exactly sixty-three copies would be wanted, with very little chance of usefully planting other copies in the hope of developing business. In view of the great cost of doing the work it was decided to abandon it and to use the money to send out a man who could personally cultivate relations with the very limited field found to exist.

**10. Cost Made and Cost Sold.**—The example noted in the preceding article is by no means an isolated case, though it is not often that activity is so grotesquely out of proportion to possibilities. The possession of a good product does not mean the possession of a good profit. Mechanically or technically a thing may be excellent, but its commercial value may be very little. It may be useful as a side line and no more. Many little specialty plants are founded, only to disappear in a short time, just because the expense of selling the article takes all the profits. The cost of a thing *made* is a very dif-



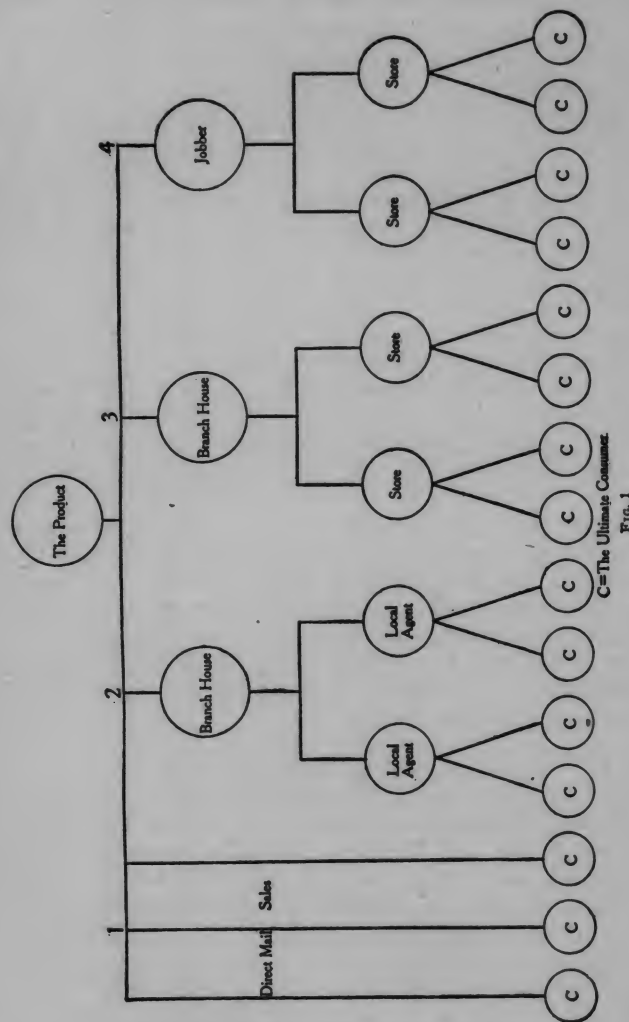
ferent matter from the cost of the same thing *sold*. The world is full of wonderful devices and appliances that lack supporters. Why? Because, though it is easy to set up a plant and make these things, it would require much capital to keep the field until the ideas embodied in the devices were sold to the ultimate consumer. It is not surprising, therefore, that the modern sales promoter begins by ascertaining what relation his product has to the possible users or consumers. It is not merely the number of possible users that counts—a device may have every factory or every office for a possible customer; much depends also on what degree of inertia must be overcome in persuading the public to use the article. A very expensive, complex device, although labor-saving and perhaps doing something that could not otherwise be done readily or at all, may be adopted ultimately by every office or plant in the country, but it may take many weary and discouraging years of pioneer work to get to that stage.

**11. Ultimate Consumer.**—The relations of the manufacturing firm to the ultimate consumer are very important elements in sales promotion. In former times no self-respecting manufacturer did other than wholesale business. The private consumer was entirely beyond his field of vision. The same cannot be said today. The tendency is for the manufacturer and the ultimate consumer to come into closer contact, although, in many cases, from the nature of the product, there are several handlings by third parties. On the other hand, where the product represents much capital outlay, direct relations between the ultimate consumer and the manufacturer are the rule. The same may hold, though the amounts involved be small, if the selling of a new idea is the essence of the business done. Typewriters, adding and calculating machinery, and most office appliances are in this class. Cost of selling in such cases is enormous, and without direct contact the business would never pay. In regard to any product, therefore, the first question is whether it is necessary or desirable to go direct to the ultimate consumer. The alternative is selling to wholesalers or jobbers, or direct to storekeepers.

## **12. Difference Between Handling and Persuasion.**

It does not follow, because a product is handled by wholesalers or retail storekeepers, that the firm is content to leave to such agencies all the work of persuading the public to purchase just such and such product and no other. In the case of an ordinary product, where no special education in the use of it is necessary, the question of handling it through the trade is a matter of convenience from the mechanical viewpoint, rather than from the sales-promotion viewpoint. The manufacturer's part in the selling operations, in such a case, resolves itself mainly into a matter of moving goods. In a general way, goods will not move, or continue to move, unless the attention of the public is persistently called to them. It is not, however, the function of the wholesaler or even of the retailer to push other folks' business, unless paid to do so. As it is in any case a matter of expenditure, the choice lies between giving large commissions in the hope that sales will be boosted by the trade, or of spending the same sums directly in advertising and gaining the ear of the consumer himself. The latter way is perhaps the surer, since the results are more closely under the control of the firm spending the money. In other cases, where the consumer must be educated in the use of the product, the mechanical services of the trader are of very little value, and the product must be sold direct by the specially trained representatives of the company. Cash registers will suggest themselves as an instance in point.

**13. Approach to the Ultimate Consumer.**—The principal ways in which the ultimate consumer is reached are indicated in diagrammatic form in Fig. 1. The first method is the simplest, and has been developed to enormous proportions by some firms, known as mail-order houses. Such houses, however, are merchants rather than manufacturers, even though, as is the case frequently, they control numerous factories whose entire output they take for distribution. There are many disadvantages in doing business in this way. Where the articles sold are standard and invariable in grade, it is perfectly satisfactory; but when quality, pattern, texture, and



so forth are involved in the choice, satisfaction is not so easily attained. The trade of such houses was originally built up in remote country districts, where people were almost forced to buy through the mail if they wanted to buy at all. But by degrees a kind of mail-order house standard has been evolved, so that purchasers, from a perusal of the catalog, have a pretty close idea of the quality they are going to get. The preparation of catalogs is an all-important part of this method of trading. Outside this special class of enterprise, mail-order business is confined mainly to the supply of specialties carrying large profits. The theory of mail-order business is the acquisition of a customer that will stay with the firm for years, sending in more or less regular orders for small amounts, with no further expense to the firm than an annual catalog. Unless this condition exists, mail-order trade must yield large gross profits, or the expense of getting business will be too great.

**14. Branch Houses.**—Eliminating mail-order business from the discussion, and with it all communication between the ultimate consumer and the headquarters or plant, there remains the problem of reaching a great number of ultimate consumers, scattered, perhaps, not only all over the United States, but throughout the civilized world. In the majority of cases such consumers make their purchases at stores, but in certain classes of business the service afforded by the ordinary store is insufficient to push the goods. In this case local agents are appointed who are either employees of the firm or who may be selected storekeepers willing and able to give time and attention to the sale of the specialty. In either case these intermediaries between the ultimate consumer and the firm are likely to be very numerous and widely scattered. Hence, as a connecting link, branch offices are commonly set up in convenient localities, such branch offices doing all the local business with agents or storekeepers and forwarding the orders to the head office. In Fig. 1 the relations of the branch house to agents and storekeepers, respectively, will be seen under the numbers 2 and 3. In general, goods are shipped in bulk to the

branch offices and thence distributed to the local agents or storekeepers.

**15. Jobber.**—The fourth, and still the most usual method of distribution, is that shown under the number 4 in Fig. 1. Here the place of the branch house is taken by the jobber, that is to say, by a middleman who makes it his business to buy goods wholesale and sell them to the retail trade. The whole country is, in this case, covered by territories allotted to jobbers, just as, in the case discussed in the preceding article, it was covered by territories divided among branch offices. A system of distribution is necessary in any case, and the choice lies between making use of that already in existence by way of the jobber or setting up a new one under the charge of branch offices. Obviously, it is one step nearer to the ultimate consumer to eliminate the jobber. On the other hand, if the jobber's services are dispensed with, the manufacturer must assume all the labor and expense of grinding out new channels of trade, which the jobber has ready-made. Against this disadvantage must be weighed the consideration that one act of persuasion is eliminated with the jobber. For, if he is to be employed, *he* must first be persuaded, and then persuasion must again be further carried to the retailer or storekeeper. Reliance on a jobber also involves a risk. He may not be loyal. A firm that relies on the jobber may find its market seriously and suddenly curtailed because he has switched over to a competitor, carrying with him most or all of the retailers with whom he does business.

**16. Lack of Standardization.**—At the present day the methods of distribution are in a condition of flux, or confusion. Some firms adhere stiffly to the older method of doing all business through jobbers; others just as rigidly eliminate the jobber altogether; still others will sell to anybody whatsoever, grading price in proportion to size of shipment; some do business through jobbers in some parts of the country and cover the ground with branch offices in other parts; and so on. The fact is that the development of methods of distribution lags greatly behind that of methods of production. The cost of

distribution is often almost scandalous. It is probable that the near future will see great developments in this field, and if a guess may be made, progress will probably be in the direction of divorcing the handling of goods from the selling. The former is a mechanical problem, and could be met by a reasonable amount of cooperation. The latter must always remain an individual task, and it must be left to the firm making the goods to decide whether it will pay or not to attempt an extension of the amount of business in any particular field. Meanwhile, it will be seen that a considerable range of choice exists as to the method of marketing a product, and much of the success of a business will depend on making the choice best adapted to each particular case.

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#### METHODS OF INFLUENCING THE CONSUMER

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##### INTRODUCTORY

**17. Propaganda.**—Assuming the existence of a product in marketable shape, and a field already decided on, in which the product is to be sold, the next step is to consider methods of propaganda, that is, of bringing influence to bear on the minds of individuals so that they will presently be moved to purchase the product in preference to other products of similar character. What has already been said about the marketableness of product should be borne in mind, because, although the persuasive powers of the sales-promotion division may be very great, these powers will be more or less wasted if the product fails to come up to the highest standard of quality, convenience, appearance, and so forth. The better the product, the more it deserves good salesmanship; conversely, a good sales organization is so high-class and valuable a piece of machinery that it should never be employed on a task beneath its merits. All that can result from such practice will be a damaged reputation, which will affect the utility of the organization for other objects. The better the sales organization that he has developed, the greater should be the care of the executive to see

that any product offered to the public by its aid should be in all respects first-class.

**18. Direct Mail Appeal.**—The use of the mail for direct action on the ultimate consumer, the retailer, or any other class of buyer, is becoming more common every day. The campaign is addressed to the persons appearing on a carefully selected list of names, and the form letters and printed matter sent out are designed to produce, each of them, some one definite effect. Thus, the campaign may take the shape of a series of communications, each dealing with some one talking point of the product. Two ends are aimed at here. One is the cumulative effect of a well-worded series, assuming that all or most of the letters are read by the recipient. But even more important is the other effect aimed at: Each letter should strike a different keynote, that is, it should approach the subject from a different angle. If there is a series of, say, seven letters, there are seven different chances of striking the attention of the reader from some angle that will appeal to him. The importance of varying the argument is thus manifest. It will pay the executive to give considerable attention to the preparation of the circular letters in such a campaign. Often it will be desirable to employ the services of one of the firms that specialize in such work. The art of stating the case concisely, forcefully, yet without appearance of exaggeration, is not possessed by every one.

**19. Follow-Up.**—Closely related to the direct attack by means of mail matter is the problem of following up inquiries. This branch of propaganda is mostly associated with national or trade advertising, which is depended on to bring the inquiry in the first place. When the reply to the inquiry does not bring an order, it is usual to subject the inquirer to a carefully directed bombardment through the mail, at predetermined intervals. Only experience can show how far this should be kept up. A rapid-fire campaign, if not judiciously planned, may overdo matters. In any case it is well to keep a close record of the success of each piece sent out. Ineffective pieces may thus be eliminated and their cost saved. If no business

results from an inquiry, even after a series of follow-up letters, the case should be put on one side, but occasional letters should still be sent at somewhat wide intervals, since inquiries of this character have a way of unexpectedly maturing after long periods, when they might be supposed to be dead. Follow-up matter may consist either of form letters or of printed matter, or of both together. It is probable that the best effect is made by using letters sparingly, and mainly to enforce the effect of a series of mail pieces of printed matter. There is then some natural excuse for writing the recipient, considering the attention that has already been paid him.

#### ADVERTISING

**20. Field for the Expert.**—The subject of advertising in national, local, and trade or sectional mediums is one on which many volumes have been written. While mail propaganda is a matter of which the expense, though considerable, is at all times under full control, the same cannot be said of advertising. The authorization of advertising expense should therefore be very closely considered by the executive, since advertising is mostly contracted for over long periods, unless high prices are paid for short-term or single insertions. The sum to be spent in advertising should be budgeted; or determined rigidly in advance. For the most part, advertising produces only a favorable seed bed; that is, it prepares the mind of the reader to consider a definite proposition when, and only when, the latter is made. In other words, advertising, except in special cases, does not bring orders, but only inquiries. These inquiries must be turned into orders by one of the other methods described in this Section. The preparation of advertising copy demands as much attention as that of the contents of mail pieces or form letters. Inasmuch as the connected expenditure is large, and sometimes very large, what has been said as to the engagement of experts to write circular letters applies with still greater force to the preparing of advertisement text and illustration. Too many executives ignore this. It should be remembered that the contracting for space is only



the beginning of advertising. Even though exactly the right mediums are selected, the nature of the appeal that suits each medium has still to be considered. Expert assistance is very important in this field.

**21. Varieties of Advertising Aim.**—Before spending even a dollar in advertising, the executive should get a clear view of what he proposes to attain by its aid; for advertising has many uses. In the foregoing, that kind of advertising has been considered which is devoted to provoking inquiries. But all advertising has not this aim. Frequently its chief aim is to make the name of the advertiser a household word. A historical case may be cited. The vast business of the English steel-pen maker Gillott was built up early in the nineteenth century by innumerable small advertisements in the form of a visiting card, which were carried for many years in almost every available medium, not only in the United Kingdom but in most civilized countries. The card displayed nothing but Gillott's name and the fact that he made steel pens. It is more than probable that not a single pen was ever sold by this advertisement. But the name of Gillott became identified with steel pens. On the other extreme, many manufacturers carry full-page or double-page advertisements in a few mediums of nation-wide circulation. The idea is the same. It is the persistent placing of the name before millions of persons that prepares a seed bed from which orders are raised by other methods of cultivation. In this class of advertising not even inquiries are expected, and certainly no direct sales. Of late, however, a further development of this kind of advertising has taken place.

**22. Advertising by Samples.**—Large-scale national advertising has been developed by some firms in a way that has a two-fold advantage. The idea is to offer, free of charge, either an explanatory booklet concerning the firm's products, or, where suitable, a sample of the product. One advantage secured by this method is that it furnishes a check on the way in which the advertisement is influencing the consumer; another is that the names of a large number of prospects are

secured, who may be worked on later by local influences. A paper manufacturer, for example, sends portfolios of paper samples, with literature showing how each class of paper may be put to advantageous use by the private user. These firms do not sell a sheet of paper direct to the consumer. But they get their advantage by acting directly on his mind; in other words, they are selling him an idea. The handling of the paper is an altogether separate matter, which goes through a routine of jobbers and agents. In the same class is the advertising addressed to architects and professional men in their professional journals. Such men buy nothing, but they can specify the use of the product by others. The use of the sample is common in this case also, where the nature of the product permits.

**23. Dangers of Advertising Expenditure.**—The indirectness of aim which is inherent in most advertising naturally makes it a delicate and ticklish matter to handle. Probably, a very large amount of the money spent on advertising is wasted, even with all the advanced methods of design and control now in use. Where money is plentiful and the sledge-hammer type of propaganda is adopted, practically all available mediums are occupied, and the misses are absorbed by the hits. But where only a limited appropriation can be had for advertising, it becomes highly important to distribute the expenditure in the most advantageous manner. Every dollar must make its mark, if possible. The fact that no one can ever really tell the ultimate extent of the influence of an advertisement makes the choice difficult. Where machinery, for example, is being advertised, a whole year may pass without an inquiry, and yet ultimately an order will develop out of the advertisement, the value of which may pay for the whole year, with plenty of margin to spare. But in cases where profits are small, that is, where transactions must be many, there the number of results directly traceable to a given medium becomes a fair test of its advertising value. In general, especially with a young firm, only such advertising should be continued as is known to pay its way.

**24. Poster Advertising.**—An altogether distinct class of announcement is poster and bill-board advertising, such as commonly exhibited in street and railroad cars. While much of this is simple national advertising of the kind intended to familiarize the name of the advertiser, some of it has an additional purpose. It serves to connect the general idea of the product with the name of the local agent or storekeeper from whom the goods can be obtained. Automobiles, sewing machines, typewriters, and so forth are commonly advertised in this way. Less usually the poster will bear the names of several agents or storekeepers who thus share the benefit. Much of this class of advertising is strictly local, and its results can therefore be fairly well measured. Intensive campaigns in particular cities and country districts are reinforced by such advertising. The case of the posters that line the sides of railroads, mile after mile, is a different one. Except in the case of hotel advertising, such posters are in the nature of familiarization devices. No direct business is expected from them, nor could it be very well traced to its source if it came. Hotel posters, on the contrary, are expected to bring business directly, though, of course, it is very difficult to determine how much they do bring. A young firm of limited resources can use posters effectively only in connection with intensive campaigns, town by town, as only thus do they pay their way, and are they measurable for results.

**25. Catalogs.**—The term *printed matter* is a very elastic one, comprising as it does the expensively illustrated and bound catalog, and at the other extreme, a simple leaflet or card intended to emphasize some minor detail. Beginning with the more expensive forms, it may be said that the modern tendency is away from the large bound catalog and toward a loose-leaf form. There are many advantages in this. In lines where changes in detail are liable to occur (and this includes all mechanical appliances) the loose-leaf form can be kept up to date without the necessity of reprinting the whole book. A single section or even a single leaf can be printed and sent out, or supplementary leaves can be added. The disadvantages

are that the customer will frequently neglect to replace the obsolete matter by that sent him. For this reason some firms prefer to get out their catalogs in thin sections of perhaps twelve or sixteen pages, more or less, and issue them in a numbered series, with a notice that all previous issues of that section are cancelled. Another disadvantage is that loose-leaf publications lack the imposing form of the bound book. If much consulted, they are apt to become untidy by tearing of the pages at the fastenings. Nevertheless, it is probable that the loose-leaf or sectional system is destined to gradually replace the bound book. New firms will do well to adopt the loose-leaf form, giving considerable care to the details of the covers and method of securing the papers therein and to facilities for addition and replacement of pages.

**26. Mail Pieces.**—The term *mail piece* is used to denote a class of publicity matter of a character somewhat different from that of catalogs and price lists. The latter are, usually, simple statements of sizes, prices, and qualities. Mail pieces, such as booklets, folders, cards, and leaflets, are, on the contrary, mainly argumentative. Each seeks to emphasize some particular point; it is a means of exercising influence on the judgment of the consumer. The preparation of this class of printed matter is a work of considerable importance. While the catalog represents sober fact, the folder represents fact interpreted by a little imagination. This does not mean that anything but strict truth is to be told; but the truth must be told in a lively and catchy way so as to arrest attention and provoke interest. The folder or other mail piece bears the same relation to simple catalog matter that headlines in a newspaper bear to the news told under them. Each such piece should ring on a keynote, and the more definitely it harps on this keynote, the better. The object is to hammer home a single impression, and this must not be weakened by attempting to cover more than a very limited aspect of the whole set of facts. Such literature should be short, concise, well produced in point of type and color, and may be illustrated, if the subject matter permits. Pictures always speaks for them-

selves, but they must be part of the story. Expert assistance in designing such printed matter will usually repay the expense.

#### THE SALESMAN

**27. Procuring Orders.**—In the majority of cases (except in the mail order business) it is the work of the salesman to procure orders. The term *salesman* is very elastic, including in its scope, at one extreme, the technical expert, highly educated and highly paid, who handles business involving large capital sums, and, at the other extreme, the house-to-house canvasser. The average salesman is a man with a reasonable knowledge of the goods he sells, sufficient at least to bring forward a variety of arguments in their favor, and gifted with sufficient personality to meet and deal with a great variety of buyers. In recent years much study has been given to the problems of salesmanship.

**28. Training of Salesmen.**—There can be no doubt that some men are naturally gifted with a talent for salesmanship. But, as in all such cases of a special gift, those possessing it are comparatively few. Also, like many other clever and talented men, these naturally gifted salesmen are apt to be difficult to handle, and are with difficulty brought into line with rigid system. On the other hand, the very scarcity of such men makes it necessary, in the case of any large organization, to build on the basis of the ordinary or average salesman. In such an organization the exceptional man will hardly find a place. The one final test of capacity is the actual record of goods sold; and in a large organization a high average throughout is preferable to brilliant results in one place and poor results in another. All the methods employed to sift candidates tend to bring forward just the type of man who can be built into an organization, that is, the man of average gifts. Such men must, then, be trained on a uniform pattern, and furnished with standard stock arguments. When it is seen that they have a reasonable understanding of the merits of the goods, they are sent out, and careful watch is kept on

their efforts. While special care has thus been taken in developing the average salesman, this must not be taken to imply that there is no place, today, for the specially gifted, the born salesman. He still maintains his superiority when working under conditions suitable for the free display of his gifts. But his field is different from that of the unit in a large sales organization; each type of salesman has its own place.

**29. Place of the Natural Salesman.**—The smaller the organization, the greater the necessity for finding and keeping the gifted natural salesman, because the small firm has neither the requisite facilities for training the average man, nor can it rest content with a small uniform average of success. The place of the natural salesman is, therefore, with the specialty firm, where unusual situations are constantly being met, and stock arguments and standardized approaches are apt to fail at the critical moment. Where business is being done with hundreds of regular buyers, themselves immersed in a routine, it is conceivable that training can be arranged to meet all situations likely to occur. But not all business is of this character. A *man*, rather than a *method*, is required to handle some negotiations, and when this is the case the natural salesman will have great advantages over the machine-made article. In deciding on his salesman policy, therefore, the executive should consider exactly what kind of business he is about to do, and whether the average man, properly trained, can serve for his needs, or whether it is necessary to look farther afield. Of course, even the natural salesman needs to be in intimate touch with the points of the product, but it will usually happen that the information he selects for himself is sufficient for his needs.

**30. Demonstrations.**—When the article to be sold has solid superiority, no kind of influence that can be brought to bear on the consumer exceeds that of the demonstration. To actually see and handle the article, or observe it in action, naturally exerts on the prospective customer a favorable influence that can be obtained in no other way. In nearly all business, therefore, the aim is to get the prospect into personal

contact with the thing that is to be sold. The sending of samples, the offer of trial orders on special terms, the holding of demonstrations in stores, and the occupation of space in trade exhibitions are all means to this end. In the case of machines it is usual to try to get the prospect to allow a trial in his own premises and on his own work. Nearly all office machinery is sold in this way, and in special cases, factory machinery also. Many publishers of technical books send them for inspection before purchase, and the same plan is adopted

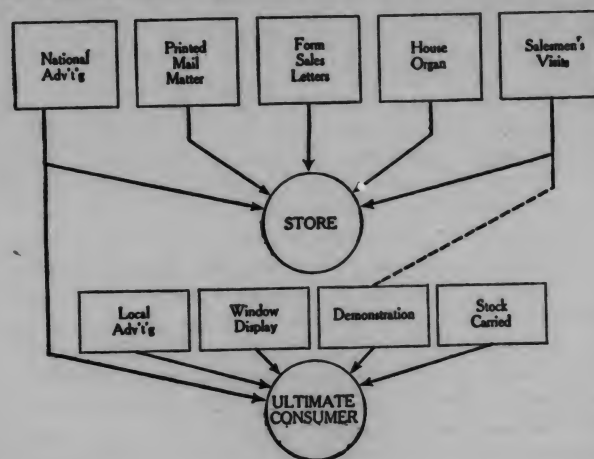


FIG. 2

by publishers of sets of standard authors, encyclopedias, etc. The universality of this practice shows that it is usually a paying one, notwithstanding the risk and expense incurred. It is the average, or net result, that counts. Consequently, where the free trial or a similar plan is adopted, very special care must be taken to record the results of each transaction, and to keep close watch on the costs and profits. This is particularly the case where long credit is given on the instalment plan.

**31. Review of Methods of Influence.**—Two favorite types of selling method are shown in diagrammatic form in

Figs. 2 and 3. The former represents the case where business is done through storekeepers, while the latter represents business done through local agents, where service is an important point in the selling argument. Office machinery, sewing machines, and all light mechanisms are usually in this latter class. In each diagram, what should be particularly noticed is the influence brought to bear on the ultimate consumer, and the avenues by which he is approached. It will be observed that in the second case, that represented by Fig. 3, this influence

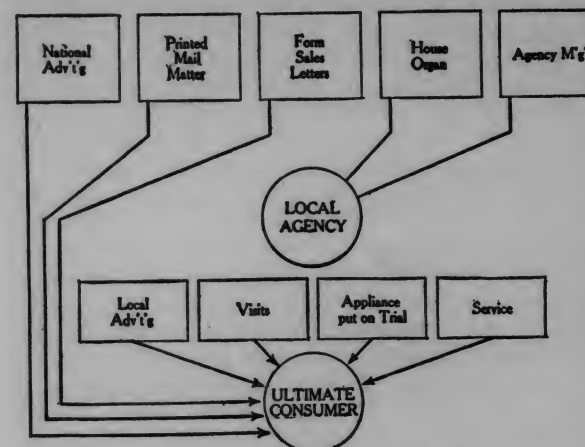


FIG. 3

is much more intimate and direct, and for this reason the plan is preferred when the article is such that an appeal must be made to the intelligence of the consumer. From Fig. 2 it will be seen that the influences at the disposal of headquarters are five, namely, national advertising, printed mail matter, form letters, house organs, and salesmen's visits. But, in the case represented, none of these, except national advertising, is brought to bear directly on the ultimate consumer. All the energy is expended on the storekeeper, to whom it is left to pass on the influence to his customers by the means indicated, namely, local advertising, window display, occasional demonstrations



(assisted by the firm), and the mere fact that he carries a stock of the article. This state of affairs may now be compared with that shown in Fig. 3.

**32. Direct and Indirect Influence.**—In Fig. 3, the influences at the disposal of headquarters are much as before, except that an agency manager or traveling inspector replaces the salesman. His function is much the same, namely, to keep the local agents personally in touch with what is going on, but he has nothing to do with the taking of orders. In place of the retail stores there is the local office or agency, working to influence the consumer locally, but by different methods from that of the storekeeper. The local advertising situation is about the same as in the previous example, except that this time the advertising is confined to the individual product of the firm. Next, the agent will make calls in his capacity of salesman, and endeavor to find opportunities to place his appliance on trial, or, in other words, demonstrate its capabilities. Finally, there is the strong point of *service*, which, in the class of business now being considered, means maintaining the appliance in order, suggesting new uses for it, and working out methods of applying it to the consumer's work. It will be seen that there is here very strong local influence let loose on the consumer. But this is not all. Headquarters influence is also much stronger and more direct, because printed matter, and even form letters, may be directed to the consumer with a view to enlisting his interest. This attack is guided by the local agent, who furnishes headquarters with a list of prospects so that the fire is directed intelligently and only in directions where local knowledge judges that a useful result will be forthcoming.

#### CONSIDERING A PROJECT

**33. Introductory.**—In discussing the steps to be taken by the executive in developing a project, or organizing a campaign for marketing a particular product, it will hardly be necessary to consider the case in which a very large capital is to be expended at the outset in creating a demand. Projects

on a very large scale can be safely handled only by the aid of experts who specialize in the various departments of sales promotion. Attention here will be confined to projects of a moderate magnitude, in which the executive will have to rely in considerable measure on his own resources. As every campaign must vary in details according to the particular kind of product that is being offered, it is obvious that this discussion can be only of a general nature, indicating the kind of steps to be taken, rather than a definite program applicable to any class of campaign. Thus, the introduction of a new breakfast food, or similar article of general use, would probably be undertaken on a very large national scale, and to discuss such a project usefully would demand a volume of considerable dimensions for that alone. A campaign to market some specialty is, however, another matter, and some useful hints can be given that will assist the executive in planning his procedure and establishing an organization on a moderate scale.

**34. Points to Be Considered.**—Generally speaking, the first thing to be considered in planning a sales campaign is the probable extent of the field. An exception, perhaps, may be made in the case of an article already familiar to the public, such as a typewriter or a calculating machine. In such a case a special study of the field may not be necessary, although even here it will often bring out important facts, such as the extent of demand for replacement of worn-out and obsolete machines, the ultimate limit of what the country can absorb, etc. But in the case of a new appliance, or an article that strikes a new keynote and is not already familiar to the prospective user, it is necessary to consider very carefully not only how many prospects may exist, but also where they are located. For instance, in introducing a new machine for the textile industry, which is mainly concentrated in a few localities, a procedure would be adopted that would necessarily be quite different from that applied to the case of a machine used in iron foundry practice, since foundries are scattered widely over the country. It must therefore be determined at

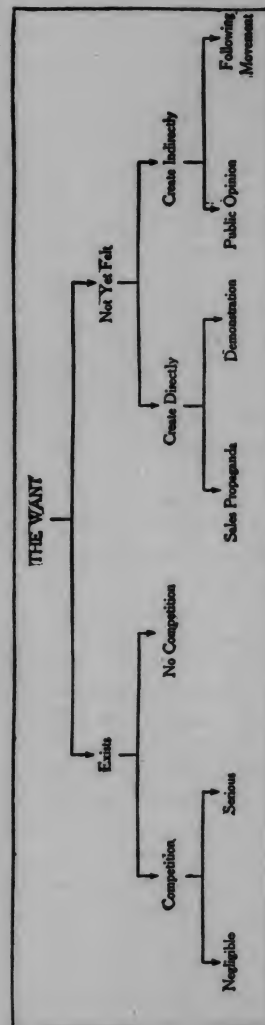


FIG. 4

the outset whether, with due consideration of the geographical conditions of demand, there is really sufficient field in sight. The best way to approach the question of the field is to begin by considering the product in the light of an article destined to fill a want. For, unless it either fills an existing want, or is of such a nature that a want can be commercially developed, it cannot be worth spending money in the attempt to establish trade.

### 35. Demand Situation.

The analysis of the various possibilities which can arise regarding a demand, or, rather, a want, for an article of commerce, is shown in diagrammatic form in Fig. 4. Either the want already exists or else it has to be created. If it exists, either competition has to be met or the situation is such that no adequate way of satisfying the want had previously been found, although the want was fully recognized. If competition is already in the field, its status must be carefully determined—whether it is of no great importance or whether vigorous action to combat it is necessary. On the other hand, the product may be such

that the want is not yet felt, but is developable. Many such cases suggest themselves. Typewriters, calculating machines, special paints, packet foods, patent shingles, and so forth have had to develop their own demand before the product could profitably be manufactured on any large scale. In such a case the method of creating the want requires consideration. The want may be created directly by the usual methods of propaganda or demonstration, or it may be fostered indirectly. Indirect creation of a want for a particular product is a somewhat subtle matter, but, for all that, it is not at all uncommon. Such indirect creation can be effected either by local agitation or by following and promoting existing movements of public opinion. Agitations for safety first, fire prevention, good roads, and so forth, may be skilfully used, by producers of suitable articles, to assist in developing a demand. Public opinion is also sometimes positively manipulated in favor of certain steps that will directly benefit particular interests. Armament makers, and producers of soft drinks and candies, have been credited with such manipulation on a large scale. Whether such allegations are true or false, the general fact remains that public opinion can be swayed to the advantage of the market.

**36. The Field.**—When it has been determined that a field of sufficient importance exists or is developable, the next step is to analyze this field, in order that a plan of action may be formulated and embodied in a sales-promotion organization. Fig. 5 shows, diagrammatically, the chief elements of such an analysis. The number of probable buyers and their location or distribution is first determined, and should be marked on a large-scale map. Then their character should be discussed, whether they are in the class of ultimate consumers or whether it is necessary to approach them through trade channels. If the approach is to be indirect, then the question must be considered as to whether business is to be direct with retail storekeepers or through the usual channel of the jobbing trade. If the prospective customers are ultimate consumers, say factories or offices, then it becomes a question whether mail business

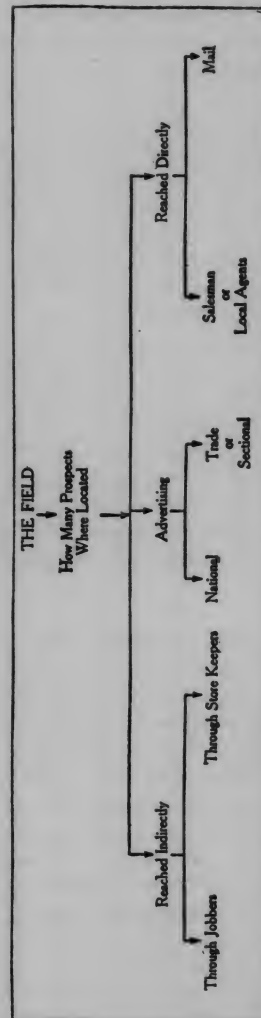


FIG. 5

should be relied on, or whether an organization of local agents should be built up, perhaps with branch offices in different parts of the country. In some cases a simple organization of salesmen will be all that is necessary. This is particularly the case where the article is a costly one, involving capital outlay, as machinery. Many parts of the country may be wholly unrepresented in such a field, for the reason that there are no users of that product in them. It will be seen that the pattern of the proposed organization depends on the result of this analysis.

**37. Claims Made for Product.**—Having settled the questions of the probable demand and the existence and extent of the field, the next step is to make an exhaustive survey of the claims that are to be made for the product. What is the idea that is to be sold? For behind nearly every new product there is some kind of idea that furnishes the reason for making that product. No wise person will set about producing a thing that he does not believe in. There will usually be some salient feature of the new product, *as the maker sees it*. What

is this feature? It is probably on this feature that the main claim of merit should be based. Such a claim may rest on one of several points. The thing offered on the market may be a new material, such as an artificial leather of a superior kind. The claim may lie in the arrangement of parts, that is, in superiority of design and adaption to use. This is frequently the case with machinery. The new article may be a device that does something no other device will do. A perfectly coordinated cinematograph and megaphone-phonograph would be such a device. Until recently all-around calculating machines and silent typewriters were in this class. The claim may be based, not on the product itself at all, but on the way in which it is presented to the user, that is, on some superior form of service. An automobile, for example, is a common article of trade; but if some one should supply automobiles with the condition of complete maintenance at a very low fixed price, that would be a sale on the merit not of the article but of the accompanying service. The claim that an appliance furthers a public demand—for instance, a road-surfacing compound offered at the time of a campaign for good roads—is an example of a claim made on the basis of public policy.

**38. Distinguishing the Product.**—When the article to be marketed is already familiar to the public, it is well, before beginning to spend money on propaganda, to seek some means of identifying the particular product as made by the firm. This is usually done by means of a *brand* or *trade-mark*. Many large businesses have been built up on the trade-mark. Common objects of trade, like pepper, salt, spices of various kinds, mustard, and so forth have been converted into revenue producers by being specially packed in parcels or containers bearing a brand or trade-mark, and by then being extensively brought to the notice of the ultimate consumer through nation-wide propaganda. With articles not of this class, that is to say, where the article does not have to be distinguished by the buyer from a host of similar ones, the brand is of less value. Machinery firms, for instance, do not

need the brand. On the other hand, makers of small tools and hand tools often make use of it. "Red Devil" glass cutters, for example, are known to thousands who are ignorant of the maker's name. The words *Kodak* and *Socony* tell their own tale. The brand or trade-mark is chiefly adapted to such articles as are issued through ordinary trade channels and sold to the ultimate consumer by retailers.

**39. Margin Available for Sales Promotion.**—One of the most important matters to be settled before launching out on a sales-promotion campaign, is the margin of profit produced by the sale of the article. It is at this point that many otherwise excellent schemes go wrong. It is also the point on which expert advice is most valuable. A firm about to engage in a campaign for introducing a new product is naturally enthusiastic as to the speed at which results will follow. They allot a certain sum for promotion purposes, but too often this sum is either selected arbitrarily or is bounded by what the firm can afford to spend. Without previous experience it is very hard for any one to guess the relation of results to expenditure, even when this is carefully budgeted in advance, after exact analysis of the situation. Where resources are not ample in proportion to the strain on them, it will be necessary in most cases for the campaign to pay its way, or nearly so. This can be done only where the margin of profit is such that a certain percentage of it, put aside for propaganda purposes as each sale is made, will finance the remainder of the campaign. Thus, suppose an article is selling at \$5, its total cost of production being \$3, and suppose it is expected to sell 10,000 pieces in a year by means of an advertising and promotion campaign. The maximum gross return on this turnover will be \$50,000, yielding a gross profit of \$20,000. If, therefore, a gross profit of 25 per cent. on the turnover is to be retained, not more than \$7,500 above ordinary expenditure must be spent on promotion, in that year. Under ordinary conditions, sales promotion should be financed from a revolving fund, replaced little by little as each sale is made.

#### ORGANIZATION OF A SALES DEPARTMENT

**40. Divisions of Sales Department.**—The diagram, Fig. 6, shows a convenient type of organization for a sales department. While the internal development and arrangement of the several divisions will vary, especially as regards the number of persons employed, according to the particular business handled, the main divisions and their essential functions will be much the same in all cases. At the head of the department is a vice-president in charge of sales. Then, reporting directly to him, are the following division chiefs: statistician, who is also the assistant to the vice-president, or his private secretary; publicity editor; business manager; field superintendent, or manager of salesmen; correspondent; export manager (only where foreign business is done or sought); estimator, who is the link between the sales department and the factory. Cooperation between all divisions is essential if the campaign work is to be conducted with vigor and success. By referring once more to Figs. 2 and 3, it will now be seen that the different influences brought to bear on the consumer are allotted to special divisions. In addition, the correspondent who handles inquiries, and the estimator who deals with priced quotations and promises of delivery, represent business actually under way. The last two features are more important in firms making specialties to order, such as machinery firms, engineering plants, etc.

**41. Divisional Functions.**—The publicity division is in charge of an editor, an expert in literary form and in preparing matter for engravers and printers, who also has a close acquaintance with the industry. In his charge is the preparation of all advertising and printed matter, and also of form letters as far as these relate to propaganda. He also publishes the house organ, if there is one, and compiles the books of instructions to salesmen and agents, in which are set forth the arguments to be used and the objections usually met, with suggestions for overcoming them. The cooperation between the publicity editor and the field superintendent must be exceed-



ingly close, as on these two officers will rest the burden of bringing influence to bear on the customer, in every possible

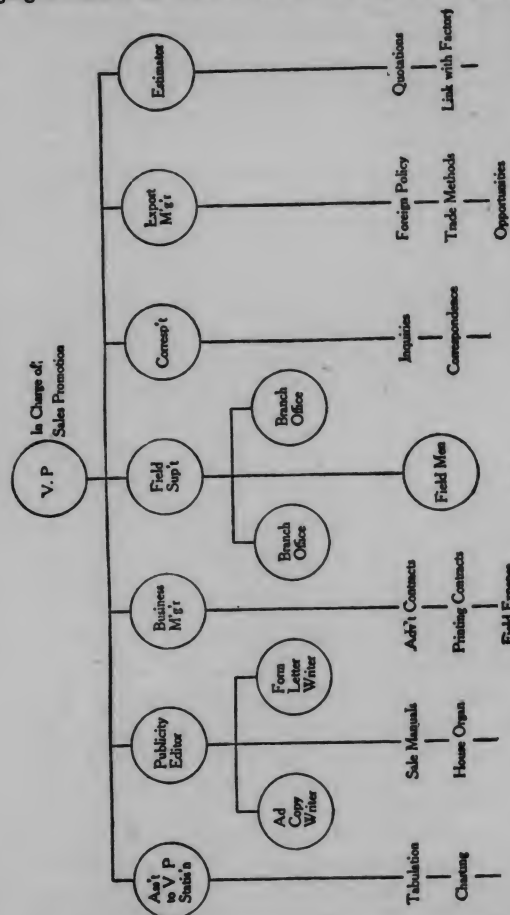


FIG. 6

form. The work of the business manager is self-explanatory. In a small firm his work would be undertaken by the vice-

president. The field superintendent has sole responsibility for all outside propaganda work. He engages and controls the field men or travelers, oversees branches, and supervises agencies. The correspondent handles incoming inquiries and, in conjunction with the estimator, makes quotations to customers. The estimator should be a technical man in close relation with the factory. He prepares quotations, and ascertains probable dates of delivery. He forms the link between the selling department and the plant.

**42. Field Superintendent's Division.**—Among the principal routine duties of the field superintendent will be that of arranging the work of the traveling salesmen. This may be considered under three heads, namely, training, routing, and quotas. The general principles of the selection and training of salesmen have already been discussed, but something may be said here as to specific methods. The idea on which all such work is founded is that of averages. In an extensive business it will be found, after some experience, that situations tend to recur. The arguments found successful with one customer will be found to apply with equal success to others. Similarly, it will be found that the objections raised in one quarter will be repeated in other quarters, and if successfully countered in one place can be so countered in another. Having found this out experimentally, it has occurred to many sales managers to take advantage of it by reducing to writing all the arguments found most successful and all the objections usually met with, and their proper rebuttal. In this way a valuable body of information is collected that can be used to great advantage in training salesmen.

**43. Sales Manuals.**—The sales manual embodies the information collected about the reaction of the customer to the propaganda. The arrangement of such a manual requires considerable care. A logical order should be adopted, leading from the more elementary situations to those of less frequent occurrence, but specifying in each case when and where each argument may be expected to be most use-

ful. In some cases an attempt is made to make the sales manual cover much more than this. It may begin with information about the firm, and the way in which the product is manufactured. Then it will take up, one by one, the salient points of the product as they should be demonstrated to the customer. This may be followed by the argumentative section already spoken of. Frequently it will be found desirable to include a brief and condensed course of salesmanship, showing how to approach the customer and to arouse his interest; when not to press him; when to close the order; and setting forth the rules and regulations of the firm as regards the routine reports, expense accounts, etc., of the individual salesman. Manuals of this kind will hardly convert a poor salesman into a good one, but they will give all, good and poor alike, the best possible groundwork on which to erect a good record. It will be readily understood that a great deal will depend on the manner in which the manual itself is prepared. While the information should be derived from the field superintendent in cooperation with his staff, the composition and arrangement should be entrusted to the publicity editor, or some one whose business it is to put ideas into print.

**44. Routing.**—To cover the field satisfactorily, it is necessary, first, to locate the customers, and then to arrange that they, or the most accessible of them, shall be included in the regular journey of salesmen. The use of large-scale maps is indicated for this purpose. Such maps should show the towns and also all railroads, trolleys, automobile roads, and other traveling routes. The location of prospects and customers is then indicated by the use of map pins with colored heads. One color represents prospects not yet reached; another, customers in good standing; a third, customers not now doing business with the firm. Then, by means of a cord, fastened to the map by small pins, the salesman's route is laid out, so as to embrace the largest number of customers or prospects with the smallest amount of deviation. Photographs of such maps may be made and given to each salesman concerned; or, if preferred, the route may be reduced to the form of written

instructions. Usually each route will be numbered and referred to by that number. Several such routes may be allotted to one salesman, much as several rural free-delivery routes run out from each post office. In fact, rural route maps of just this character are issued by the post office. Their scale is, however, too large for this commercial use. Maps specially prepared for such work can be obtained on the market.

**45. Quotas.**—The quota is a standard of performance. It represents, in effect, the budget principle applied to forecasting probable sales. First, a probable total of sales for the next year is assigned for the whole organization. Next, this total is analyzed into its component parts, each such part representing a territory or other regular division of the field. Finally, the territorial total is divided up among the individual salesmen, so that each is assigned a definite value of sales which he is expected to attain or nearly attain in the course of the year. The idea is to set a pace. Frequently this principle is combined with competitions for prizes, or simply for the blue ribbon of salesmanship. The quota system applied to collections for the Red Cross, to subscriptions for Liberty Bonds, etc., was made very familiar to the public during the World War. Each town or city prided itself on oversubscribing its quota. It will easily be understood how, under the proper leadership, such a method can be used to stimulate salesmen, and put interest into their work. The setting of quotas is based upon previous records of sales, and will therefore follow the usual course of business. It may be seasonal, or progressive throughout the year.

**46. Export Manager.**—The export division will be necessary only in concerns that operate in foreign countries. The size and importance of the division will be in proportion to the amount and variety of such business. The export manager must have special qualifications. Where business is localized, as, for example, with Spanish America, he should be a linguist at least to the extent of being able to read fluently in the foreign language. For correspondence he should be

assisted by a native correspondent where possible, as it is rare for an American to master a foreign language with sufficient success to express himself in writing as freely as one to whom that language is native. Mistakes are likely to occur in quotations and contracts where home-grown talent is left to wrestle with foreign idioms. The export manager should, furthermore, have a close acquaintance, from practical experience, with the course of foreign trade. He should preferably have resided in the country with which business is done. He must be familiar with the proper methods of packing for foreign shipment, know all about the custom-house regulations of each country, the regulations as to invoicing, the rise and fall of exchange, and, generally speaking, the whole method of doing business, which in most foreign countries is very different from that obtaining in the United States. In a large business, some of these matters will be delegated to sections of his division. He should also be on the alert for special opportunities, and know all the government and other channels through which such information can be obtained.

**47. Estimating.**—The work of the estimating division will vary in importance according to the class of business. It will attain its greatest development in engineering firms, where orders are highly individual; and even where standard machines form the main business, special attachments, modifications, and changes in detail will necessitate close figuring before a firm price can be quoted to the customer. Where only standardized articles are made, the estimating division will be absent, since the necessary figuring on new designs will be undertaken by the producing department, and the selling price of the new line will be settled by consultation between the producing and sales departments. In those cases in which an estimating division is attached to the sales department, it will form a connecting link between that department and the plant. Estimating is highly technical work, and the estimator must be thoroughly familiar not only with the class of business done, but with the actual methods of manufacture in the plant. To him will be referred the technical part of all

inquiries, and he will, after consultation with the producing department, fix the date of delivery to be promised to the customer.

**48. Routine of Estimating.**—The basis on which good estimating rests is an accurate record of costs of previous work containing the same elements as the job being figured on. The estimator, therefore, must have access to the cost records and must possess a thorough understanding of the way in which they are compiled, particularly as to the manner in which overhead expense is charged on each class of work. But he is not concerned with past history alone. As his work is to give prices for future work, he must keep posted on all changes of wages likely to affect cost of production. He must also be in close touch with the market prices of the principal raw materials that bulk largely in the product, as, for instance, the price of pig iron in foundry work, or steel in construction work. In this connection his relations with the purchasing department should be close and cordial, so that he may be able to avail himself of the information as to proximate changes in prices which it is the duty of that department to study. When a price is to be made by the sales department, the estimator's O. K. on all figures, drawings, and blueprints should be obtained before the bid is officially made. He should also pass on any promise of delivery made in connection with a bid.

#### THE EXECUTIVE AND CONTROL OF SALES

**49. Statistics, Reports, and Charts.**—In a large business, with an extensive sales organization, a very considerable number of points have to be watched, and progress of many operations observed from month to month. In the present Section attention will be confined to a consideration of such control devices as pertain to the executive's outlook on the sales situation. As in other cases, he will be concerned not so much with details as with broad results and trends. The executive's interest in the work of the sales organization may be regarded under four heads, as follows: (a) Campaign

expenditure and its results; (b) unit cost of doing business; (c) progress made in covering field; (d) degree to which customers are being held and developed. These several points will be dealt with in the following articles.

**50. Tabulating-Machine Statistics.**—In any large sales organization the statistical information required will be very burdensome unless some mechanical method of working up the figures is resorted to. It is therefore desirable that every transaction should be recorded in such form as to be easily transferred to a tabulator card. The actual details to be punched on the card will vary with each business, but in nearly all cases at least the following data will be required about each sale:

*Date.* Day, month, year.

*Customer's reference number.* This will also indicate territory and route.

*Salesman's number.*

*Class of goods,* where more than one kind is sold.

*Stock number* of pattern.

*Size* and other identification.

*Number* of items sold.

*Weight* sold, if sold by weight.

*Gross sale price.*

*Net sale price,* after discount.

*Cost price.*

*Credit allowed* (number of days.)

If these facts are recorded on a tabulating card as soon as the transaction is closed, a great variety of groupings can be sorted out by the machine, from examination of which important deductions can be made.

**51. Working Up Statistics.**—Before proceeding to the consideration of the information to be put before the executive, it may be well to enumerate briefly some of the returns and statistical tables that can readily be prepared for the use of the sales department by the aid of the tabulator, provided the original facts have been correctly punched on the cards, as mentioned in the preceding article. Among the

tabulations thus prepared may be data shown in the accompanying table:

Classification	Nature of Information
All territories	Total sales of each class of product. Total gross profit on each class of product. Number of articles sold in each class. Weight sold in each class.
Each territory separately	Same information as above.
Classification by size or stock number	Same information as above, but more fully subdivided by sizes or stock numbers.
Classification by salesmen	Quantity, weight, and value sold, and gross profit made by each salesman. Further classified by classes of goods, if required.
Classification by customers	Purchases of each class for any period. Total amount of purchases over any period. Profit to firm.

Other groupings may be extracted, if required, but those indicated will suffice to show the importance of the tabulator method to a sales organization.

**52. Campaign Expenditure and Return.**—In entering on a campaign, the amount to be expended should be determined in advance. At the same time a careful study of the probable or expected return should be made, based on previous experience or on expert opinion. Fig. 7 shows a chart that may be used for plotting these data, and also for recording actual results. It should be noted that this is a cumulative chart. The reading plotted for any month is the



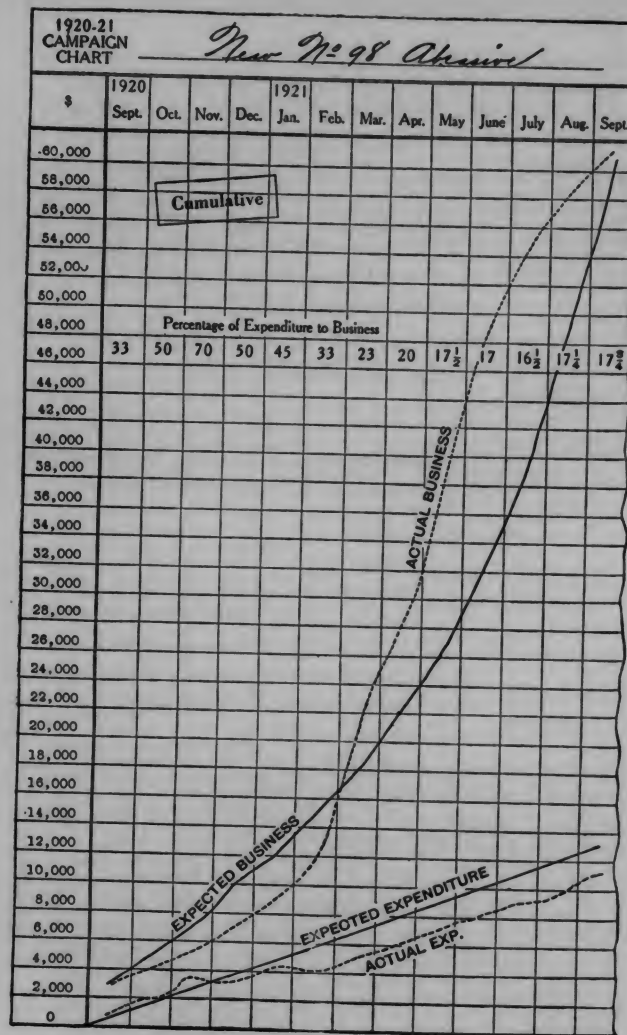


FIG. 7

total to date, and not merely the value for that individual month. Thus in April, the expected business will be seen to chart at \$22,000. This is not the amount of business anticipated for the month of April, but the amount anticipated for the entire period since the beginning of the campaign to the end of April. The total expected business is \$60,000, which should be realized by September. Below the curve so obtained is plotted a second curve for the predetermined expenditure. This is seen to amount to \$13,000 by September. Both of these curves are laid out before setting the campaign in motion. A chart of this kind can embrace the whole of the work of the campaign, and other similar charts can be set up to record subdivisions. But this can only be done when the amount of business attributable to each subdivision can be traced to its source. Thus, one such chart might be devoted to the expenditure on trade paper advertising and its returns. A similar chart would then be devoted to all other sources and a third chart would combine the figures of these two.

**53. Plotting the Results.**—From month to month, as the results are ascertained, the corresponding figures are plotted, cumulatively, on the chart. In Fig. 7 the dotted lines represent the actual transactions. It will be noticed that at first the campaign fell behind expectations. This continued until the end of February. Thereafter matters mended and the results were in advance of expectations. Finally, by the month of September, expectations and actual results came out about even. Across the upper end of the chart are given figures representing the percentage (cumulative) of expenditure to business done. In November this ratio was as high as 70 per cent. Thereafter it declined to 17.75 per cent. A study of the chart reveals that in December the rate of expenditure was checked, but it increased again slightly in January, fell off in February, and thereafter continued normal, as indicated by the fact that the dotted line runs nearly parallel to the solid line. But, owing to the holding up of the expenditure in the months of December and February, the total expenditure has been less than originally planned. A chart

of this kind (and, indeed, almost any business charts) is intended, not to be read as a mere historical record of the past, but to be consulted month by month, when the month's figures are freshly entered. It is as a guide to action that such charts are valuable. It may be supposed that the reduction in expenditure in December was effected in this way, in response to the warning indications of the chart at the time.

**54. Unit Cost of Inquiries and Orders.**—Inquiries being on the one hand the result of an advertising campaign, and on the other the raw material of orders, it is necessary for

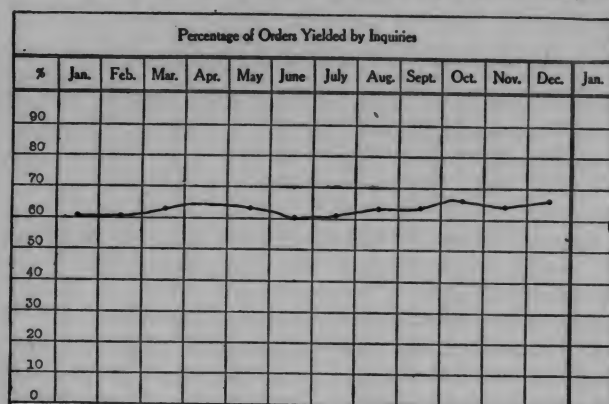


FIG. 8

the executive to keep watch on the unit cost of inquiries, and then on the extent to which such inquiries are turned into actual business. Further, the unit cost of orders should also be charted. If an advertising campaign up to a certain date has cost, say \$1,200, and has yielded 1,500 inquiries, the unit cost is 80 cents per inquiry. Now, if 10 per cent. of such inquiries yield business, the unit cost per order, from that particular expenditure, is \$8. If 60 per cent. yielded business, then the unit cost of an order is only \$1.33. These figures should be charted each month, as the campaign progresses. Fig. 8 shows a chart of percentages of inquiries

yielding orders. As shown, the chart is cumulative, that is, the percentage is the percentage to date, from the beginning of the campaign. If desired, each month's percentage may also be charted on its own merits. The chart shows a fairly uniform average of 60 to 65 per cent. of inquiries being turned into actual business.

**55. Covering the Field.**—A matter that deserves systematic attention on the part of the executive is the extent to which the known field is being covered. This is a point that is very apt to be overlooked where a thriving business is being

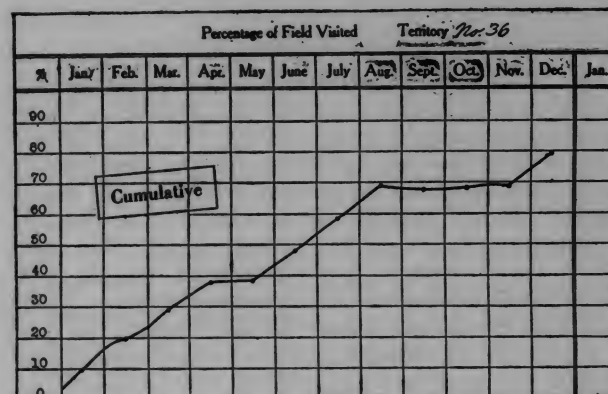


FIG. 9

done. Before such a matter can become the subject of investigation it is obvious that a geographical survey of the sales situation must have been made, as suggested in former articles. But when the extent of the field, that is, the number and location of possible customers, has been determined, then it becomes of importance to ascertain, from time to time, just how much of this field has already been covered and how much is as yet unworked. Travelers' reports are noted on the field or territory lists, and names are marked off as visited. Then each month these lists are gone over by the statistician, and the ratio of firms called on to the total number in the territory

is found and entered on a chart such as that shown in Fig. 9. This chart is cumulative from the beginning of the year. The chart shows steady progress in covering the field in No. 36 territory until April, then a halt, progress again from May to August, then no progress until November. Up to date (December) 80 per cent. of the field has been covered. Every month the executive will look at the chart, and judge by the shape or direction of the curve whether special measures are needed. He will make his decision in the light of his knowledge of current business; thus, the let-up from August to November, on the chart illustrated, may have been quite within the bounds of propriety, if unavoidable circumstances known to the executive duly accounted for it.

**56. Watching Field Quotas.**—The extent to which a territory is being covered by the field men is a different matter from the fulfilment of the quotas assigned. In fact, these two things tend, if anything, to work in opposite directions. If the quota is being filled or passed in a territory, the chances are that the field men will not be so alert in covering the unexplored portion of the field in that territory. The chart, Fig. 9, should therefore be placed alongside that shown in Fig. 10, which latter relates to the way in which the quotas are being filled in each main territory or sales district. The chart is cumulative. It therefore indicates, at any moment, the business done since the beginning of the year or season, compared with the expected business. The actual value in dollars of the orders expected and received is shown at the left hand of the chart. The solid line represents business expected, the dotted line business actually done. By reviewing such a chart each month, the executive is able to see at a glance just how matters stand in each sales district. Any variation from expectation, or any sudden change in the curve of actual results, will suggest further inquiry into the case.

**57. Variation in Customers' Accounts.**—As it costs a good deal to get a customer, it is very necessary to see that he is held, when obtained. This question may be viewed from two aspects, that of averages in any territory, or all territories,

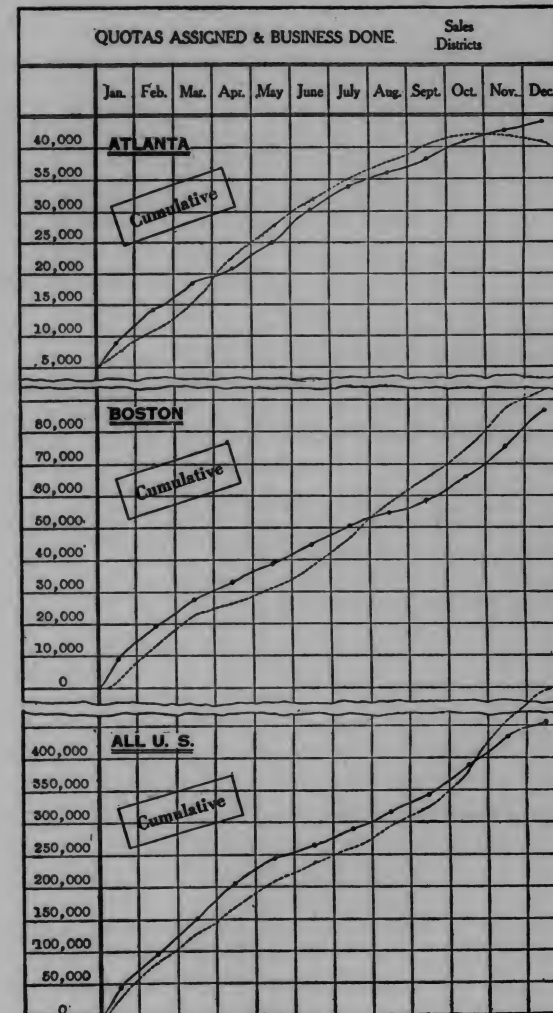


FIG. 10

and also that of individual customers. The keeping of a close watch on details like these is not very easy, or rather cannot be lightly undertaken on account of expense, unless the tabulating machine method of working up statistics is in use. When this is the case, the machine will readily sort out the information required for the two charts shown in Figs. 11 and 12. It will be remembered that among the information punched on the tabulator card were: (a) identification of customer, and (b) amount of sale. It is easy, therefore, to obtain, by machine sorting, the total of business for each customer. Having found this it is an easy matter, again, to mark off on a ruled sheet, in which of several classes the quarter's trading with that customer falls, whether the total amount of orders is below \$50, or between \$50 and \$100, and so on. The limits of the classes will be adjusted to meet the conditions of each business. For some the \$50 minimum might be too high, for others absurdly small.

**58. Holding the Customer.**—The chart in Fig. 11 does not concern the executive so much as the field superintendent. Each chart represents a definite locality or town. As shown, the totals are for a three months' period, but they may be made monthly if desired. A glance at the lowermost curve on the chart shows the general trend of business in the whole locality; above it is seen the representation of the facts regarding individual accounts. Any persistent drooping or sudden stop in a customer's curve will point the need for inquiry. As read from month to month, such charts convey at a glance a bird's-eye view of the situation in each territory.

**59. Accounts by Classes.**—The same set of facts, put in condensed form and from a somewhat different viewpoint, is exhibited in Fig. 12. Here the growth or decline of the size of accounts is shown. Each chart provides space for four quarterly reviews. Accounts are grouped according to amount of business done in the period. The number of accounts in each class is shown in the left-hand column. Referring to the figure, it will be seen that Denver district shows a satisfactory growth in all classes of accounts. Omaha,

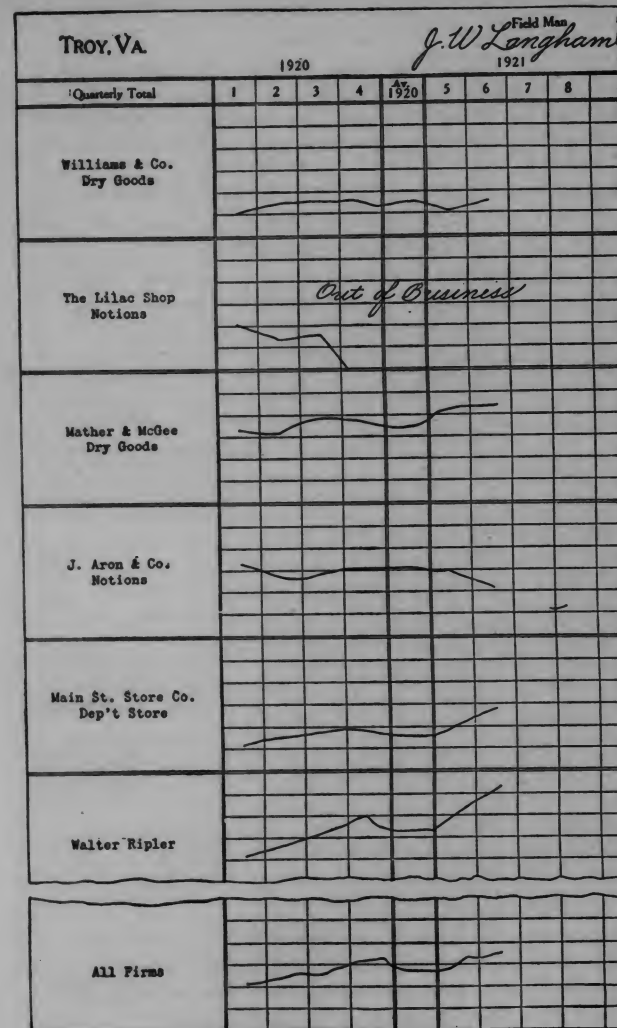


FIG. 11



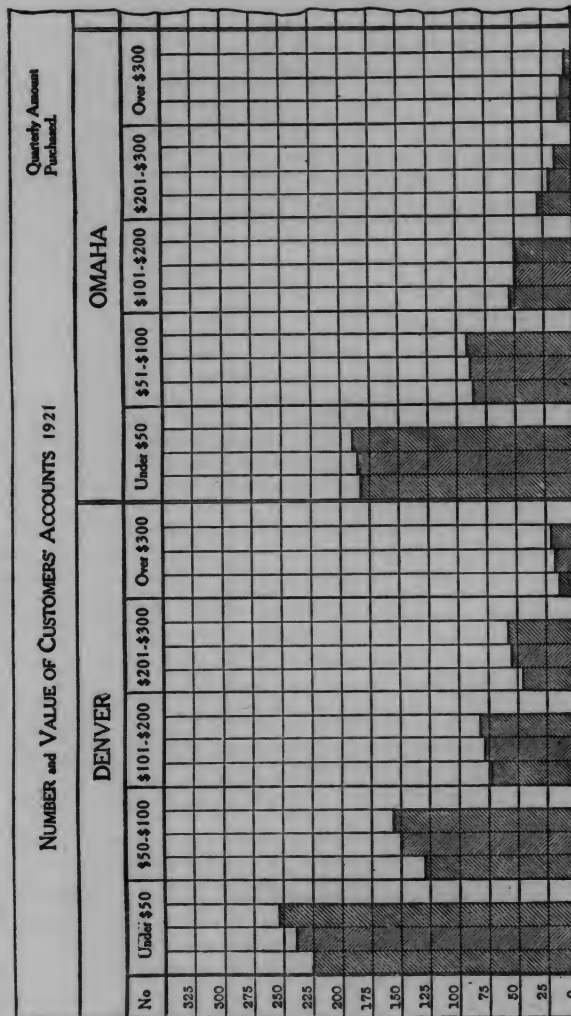
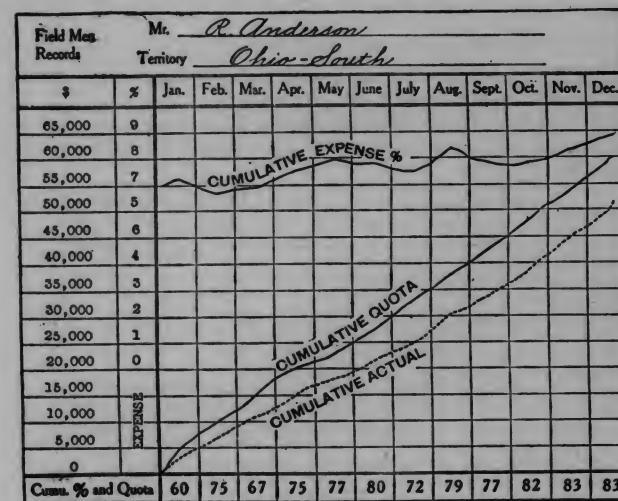


FIG. 12

on the contrary, shows a very small increase in the smaller classes, but a falling off in the larger classes. Observing this, the executive will certainly call for a report from the field superintendent as to the reason for this bad showing.

**60. Individual Salesman Efficiency.**—Another chart of interest to the field superintendent rather than to the executive is shown in Fig. 13. The readings are cumulative



from the beginning of the year or the season. The chart gives an individual salesman's quota, and also the actual business he has done up to date. (The requisite data are most conveniently collected by the aid of the tabulating machine.) The ratio of his expense account to the business actually obtained is plotted near the top of the chart, and shows a variation between 7 per cent. and 9 per cent. This particular man is running behind on his quota, while his ratio of expense is rising. At the foot of the chart the figures of the ratio (cumulative) of actual to expected business are given.

## EXERCISES

- (1) State the limitations of the mail-order method of reaching purchasers, and indicate conditions under which that method is well adapted to bring good results.
- (2) (a) Why do many large firms on the whole prefer to employ the average type of man on their sales staff, rather than the exceptional type? (b) Show how such preferred employment of the average type of man depends, for success, on definite system. (c) What are the salient features of an appropriate system?
- (3) What is meant by a jobber?
- (4) Discuss the cost of sales promotion (including advertising) in its relation to (a) a large, old-established firm, (b) a smaller firm starting in business. Illustrate by means of a numerical example how the money spent on advertising should be regulated in relation to the turnover and profits.
- (5) In making use of a succession of letters, pamphlets, and the like, to interest prospective customers, what should be the fundamental guiding principles, as regards the message carried by each mail piece?
- (6) Indicate some of the special qualifications an export manager should possess.
- (7) Explain by means of a numerical example what is meant by the unit cost of inquiries and the unit cost of orders.
- (8) Describe a method by which the field superintendent can keep himself posted on the progress and efficiency of each individual salesman on his force.
- (9) Discuss the advantages and disadvantages of the loose-leaf catalog.
- (10) What class of goods are particularly benefited by bearing a trade-mark?

## CHAPTER VII

## EMPLOYMENT, WELFARE, AND LABOR

## INTRODUCTORY

**1. Range of Discussion.**—All industrial operation consists of changes wrought in material by properly guided application of labor. Labor, therefore, is one of the most important elements in industry, and, as it is not a mere inert and passive element, like material, but involves living agents, labor introduces into industry some of the most delicate problems with which the executive has to wrestle. In this Section labor will be considered, not in its specific application to individual operation, but in the gross, or in the abstract, as a separate element of industry, with which the executive has a range of relations entirely different from any thus far considered. In one sense, labor is a commodity purchased; and, just as in making any purchase, so in engaging labor, it is necessary, first of all, to have a clear understanding as to just what is to be purchased. A second, equally important question then arises, namely, how far that which is offered is actually suited for the purpose in view. Labor must, furthermore, be studied as a body requiring to be governed, since it exists in association, and rules for such association must be established. Lastly, an environment for the labor must be provided, that is to say, suitable conditions of work and play, so that the human machine, like any other machine, may function under the most favorable conditions. Taking a broad view of all these different aspects of the labor situation, there must be estab-

lished and organized a definite system or attitude that may be termed the labor policy of the firm. A survey of such matters of labor policy will form the subject of this Section.

**2. The Executive and Labor Policy.**—Perhaps in no matter is the influence of the executive more important than in the policy adopted toward labor in a plant. The personal reaction of the executive toward problems that arise is what, in nine cases out of ten, determines the entire labor policy of the plant. In this sphere, more perhaps than in any other, the executive sets the pace, and his subordinates do little more than follow the pace so set. If the executive takes a broad-minded view of the matter, realizing that employes are human beings and that it pays, in the strictest business sense, to study, and even to some extent to humor, their peculiarities, a very different atmosphere will be created in the plant, than if he looks on the wage-earner as an untrustworthy tool, to be sharpened by continual friction, and thrown out at the slightest signs of inefficiency. Each of these attitudes has its representatives in industry today, but the broad, humanitarian viewpoint is beginning to supersede the narrow, mechanical attitude, and the most successful plants today are those in which the human dignity of the workers is fostered and their individuality is cultivated. But the more advanced attitude is a comparatively new development, and may be said to be still in the experimental stage.

#### LABOR TURNOVER

**3. Turnover of Labor Unprofitable.**—One of the reasons why employers and executives have recently taken up the study of industrial relations in earnest, is the discovery that a labor force which is rapidly changing its units is a very unprofitable one. It has been found by careful investigation that the mere act of firing one man and hiring another in his place introduces an item of considerable expense. But this is only the beginning. No new man falls at once into his place, even if he is a skilled worker. Strange surroundings will prevent his attaining full efficiency even on work with which he is

quite familiar. As a rule the new worker has to be taught and trained to the work he is set to do. Whether this is done by special training departments or instructors, as is now the practice in many plants, or whether he falls into place by the time-honored and very unsatisfactory method of picking up the work by watching his fellows and adopting some half-understood instructions from a busy foreman, the result differs only in degree. There is a loss of production. This means, usually, not only a loss in manual production, but also that an expensive machine is being held back from maximum output.

**4. Indirect Losses Caused by High Labor Turnover.** The economic damage caused by a high labor turnover is not confined to the damming up of production at the source. In other ways, direct and indirect, efficiency is impaired. Directly, money loss is caused by the spoilage of work. New, untrained labor is not only slow, but it is also awkward and inaccurate. It does positive damage. It wastes material, it spoils work that may already have had costly processing performed on it. It also puts machines out of adjustment, injures tools, probably gets tangled up in the new system with which it is not familiar, and causes trouble to timekeepers, cost men, and paymasters. And last but not least, new labor requires an undue amount of supervision. This is equivalent to saying, in most cases, that supervision is withdrawn from essential matters simply to keep a new operator in going condition. A busy foreman who has his mind full of important detail is compelled to waste time putting the new man in touch with the practice of the shop, teaching him new ways, and altering, most probably, his whole viewpoint, formed under different circumstances in other plants. Thus catalogued, the disadvantages of high labor turnover need no demonstration.

**5. Other Drawbacks of Labor Turnover.**—There are at least two further reasons why permanence of employment should be made part of the labor policy of a firm. The most obvious is that when changes are being frequently made, that is, when hiring and firing are part of the regular routine, without any particular attempt being made to secure definite

qualifications on the part of men hired, it is more than probable that the defect found in the man of today will, on an average, be found in equal degree in the man of tomorrow. Another consideration is that a man once familiar with the plant and its customs and ways is likely to be more valuable than a stranger, in *some* capacity, even though a proved failure in that for which he was hired. Very few men indeed are so worthless as not to be good for something. The modern discovery is that it is worth while, from an economic and practical viewpoint, to find out just what that something may be.

**6. Technical and Vital Defects in Men.**—A distinction must be drawn between mere want of skill, or suitability for a given job, which may be termed a technical defect, and grave faults of character, which would extend their influence to any and every job for which the man might be selected. Human nature is a very composite thing, and very few men, if any, approach perfection in all directions. A man may have a grave defect of character in one trait, which may be compensated by correspondingly developed virtues in another. An individual may be lazy or slow, and yet very faithful. Another may entirely lack initiative, but may be competent to be trusted to carry out definite instructions with minute accuracy. It is not uncommon for men who show extraordinary skill and intelligence for long periods, to have spells of dissipation from which no consideration will withhold them. On the other hand, if a man is an habitual drunkard, or an habitual liar, or if he is a trouble-maker, or liable to outbreaks of violent temper, such defects militate greatly against his fitting into an organization, whatever his virtues may be. Defects, then, may be regarded as divided into three classes: (a) technical defects, removable by assignment to the right job, and by training; (b) character defects, such that the individual may be fitted to a post in which his shortcoming is harmless; (c) vital defects, which are so serious that the man cannot be relied on for any purpose. Whatever the proper sphere of a man suffering from a vital defect may be, it is certainly not in an industrial plant.

### LABOR ENVIRONMENT

**7. Inside the Plant.**—All that has been said, hitherto, has reference to the bringing in of men from outside to replace those thought to be inefficient at their tasks. But this problem is closely allied to another, namely, the atmosphere or environment that is set up inside the plant itself, and its reaction on the workers. The executive of the old school believed in rigidity of rules, in military discipline and military obedience, in conceding nothing and demanding much. Success can no longer be expected with this system. The tendency of the day is in another direction altogether. The phrase "industrial democracy" sums it up. In other words, in place of the military system the new idea is "government with the consent and by the aid of the governed." We must not be led away too far by a belief that the industrial problem is thereby solved. It is only a tendency that is so far observable. But it is a tendency that the modern executive needs to watch very carefully, and of which the practical limitations should be thoroughly understood. For self-government implies fitness on the part of the governed. Each worker must bring something to the common stock, as well as each executive. Merely setting up a mechanism of self-government is valueless and exceedingly dangerous unless the right spirit is present.

**8. Secondary Considerations.**—Whether or not industrial democracy ultimately proves a success, the thorough discussion that the subject has received cannot but leave lasting useful results. A new standard of what is due, as a minimum, to the worker, has been set up, and will certainly not be reduced in our time; the executive must expand his ideas of the worker's place and duty beyond the conception of him as a living and somewhat uncertain and intractable piece of machinery. In other words, in every modern plant there is an aspect of the worker to be considered that is wholly apart from his work. From a practical viewpoint, all this concern about the worker is no more than what the employer's own interests demand, even if the worker is looked on merely



as a piece of machinery. For even from a purely selfish and utilitarian point of view the employer is interested to know, and to know as exactly as possible, the inclusive and general conditions under which the human creature functions best as a worker.

**9. Physics and Psychics.**—The growth of a plant depends upon purely physical conditions. Not so the welfare of the human being. Though he is just as sensitive to physical influences as the plant, he is subject, in addition, to other and perhaps even more potent influences, usually termed psychological. If the plant is put under unfavorable conditions, it dies, but it does not worry. On the other hand, the human creature may have excellent physical conditions and yet find plenty to worry about. The worker has, in other words, not only a physical environment, but also a mental, or a psychological environment. Either can affect him adversely, and it is the executive's task to understand the range and extent of each. Common-sense needs to be strongly invoked. It must always be kept in mind that the primary object is an industrial one. Just as far as it is found profitable to provide improved conditions, it should be done, and no farther. But an intelligent grasp of what is ultimately profitable is necessary. In dealing with the personal reaction of the executive toward ideas that are, after all, very new, it is difficult to speak otherwise than somewhat vaguely. The first thing to understand is, however, that the welfare of the worker has two aspects, one easily grasped, namely, his physical comfort, and one less easily, namely, his condition of psychological satisfaction.

**10. Illustration of Psychological Environment.** The phrase *physical comfort* requires no explanation. Everyone understands that for physical comfort a man requires such things as a suitable temperature, so that he shall be neither too hot nor too cold; he must have time to eat and drink; plenty of light for working; sweet, pure air, free from fumes, to breathe; and so on. A little less obvious, perhaps, is the phrase *psychological environment*. And yet, it is clear enough. Every-

one knows that true comfort depends, not only on such physical conditions as those enumerated, but also on a man's state of mind, and on the conditions, the psychological environment, that determine this state of mind. He must feel at home in his surroundings, not oppressed by fear of those over him, nor by fear of dangers that may lie in his path; he must not live in a maze by reason of imperfectly understood instructions, nor be hampered by rules and regulations impossible to observe; but on the contrary, he must understand his job, have confidence in his superiors, feel at home among his mates, be free from care through exposure to unnecessary dangers, and must generally pass a contented and happy day, with reasonable joy in his work, and a feeling that life is not a miserable round of petty annoyances and petty tyrannies. Under such conditions, it is probable that his work will be more satisfactory, both to himself and to his employer, in quality and quantity. The modern idea is to develop just such arrangements in the internal organization as will induce this condition of psychological contentment, simply because it is found, as a matter of stern practice, that it pays to do so.

**11. Influence of the Executive.**—There is no ready formula, no set of stereotyped principles, that can be recommended as leading to the attainment of a good psychological environment. On the contrary, since it is a mental attitude that is to be evolved, so only by a mental attitude can it be brought about. This attitude must begin with the executive. There is no possible alternative. Whether the establishment be a five-million dollar plant or a small business of fifty employes, the active executive is the man responsible for the spirit existing in the organization. Nor is the matter one to be mastered by a sudden resolve, or in a moment of generous enthusiasm. There must be a fixed attitude arising out of a profound conviction. Only in that way can the steady pressure of the executive's will be effectively exercised throughout the plant. Results in all cases must be a matter of time, and will often be obtained only after much discouragement. It is therefore *knowledge* that must be first acquired—a knowledge of some of the methods

and devices by which the right spirit can be engendered and made at home in a plant. It is the object of the remainder of this Section to describe some of these methods in brief.

#### JOB ANALYSIS AND LABOR SPECIFICATION

**12. Fitting the Man to the Job.**—When it is desired to purchase an article of an important character, it is the modern practice to make a technical specification of the qualities sought, and to provide tests by which articles offered may be judged in the light of this specification. Something of the same kind is now being attempted in the case of the purchase of labor. Job specifications are prepared, detailing the qualifications desirable for any one who aspires to fill each job. At the same time, a method is worked out for ascertaining the qualifications of applicants for jobs, and recording them systematically. In this way the requirements of each job are clearly determined, and also the qualifications of each applicant. It is then merely a matter of fitting the right key into the right keyhole, as it were, or fitting the right man to the right job, with ease, precision and certainty. Moreover, in many cases it is found that, providing the applicant possesses certain fundamental qualifications, he can be trained for a job before being turned loose in the shops. This is a stage further in fitting jobs and men together.

**13. Rough Classification of Labor Qualifications.** In classifying jobs the first and most obvious division will be between jobs in which physical strength is necessary or desirable, and those in which it is of no particular consequence. The next distinction drawn may divide those requiring a thorough command of the English language from those in which this condition is not stringent. Some jobs may be wholly of a routine character; others demand that the worker shall be able to receive and understand frequent instructions, verbally, or in writing. Again, certain jobs require manual dexterity, so that workers with clumsy hands are disqualified. Other positions notably call for patience, so that an obviously nervous or irritable candidate would not be selected. Others, again, require driving power, and call for a full-blooded, forceful type

of man. And so on. It will be seen that classification of jobs implies a careful preliminary study of the different jobs by some qualified person who has had, preferably, some training in a psychological laboratory. The cruder subdivisions, like those just enumerated, will be established first. Afterwards they can be refined, if thought desirable, until a complete bill of particulars for each job is compiled. In all such problems, common-sense must be allowed to have control. The tendency is apt to be to go on developing and refining beyond the practical needs of the case. Hence, the expert's work should be frequently reviewed by the executive, until a practical atmosphere is established. With these precautions the advantage of job specifications is real, and will, no doubt, be considered as essential in the near future.

**14. Use of the Job Specification.**—Assuming that the jobs in a plant have been subjected to analysis as described in the preceding article, the next question to consider is how this analysis is made use of in practice. In a rough way, it corresponds to the technical specifications issued to the purchasing agent for his information in buying material. Consequently, it will be made use of by the man who has the task of purchasing labor, namely, the employment manager. And just as the purchasing agent has his price lists, catalogues, and files of quotations to turn to when he is about to fill a requisition for material, so the employment manager has his files of applications for jobs. On receipt of a requisition for labor, he will consult his files to find whether any application fills the demand before him. Evidently, if the records of job analysis before the employment manager are to be of service in fitting applicants to vacancies, there must be a definite parallel relation or correspondence between the system followed in making and recording job analysis and specifications, on the one hand, and, on the other, the system followed in making and recording analyses of applicants.

It is, of course, essential that the system of classification of jobs should be of such a nature that it can be translated into practical terms on the application blanks.

**15. Employment Classification Standards.**—The problem, then, is not simply a matter of applying psychological analysis to jobs, but of setting up a classification that can be readily applied on the one hand to applicants, and on the other to jobs. The analytical expert and the employment manager must work together. Indeed, in a plant of any considerable size, the latter official should be a man of such caliber that the expert may be one of his staff, because the whole object of the analysis is to provide the employment manager with certain touchstones by which he can make a practical classification of men. The analysis is entirely useless for any other purpose. It is only a means for rapidly and accurately picking out men with certain qualifications, which qualifications have been found to fit certain jobs. Consequently, unless the analysis is expressed in terms readily understood and applied by the employment manager, the whole performance is wasted energy. It is therefore indispensable to set up in practical language and in practical terms a standard classification for applicants, the same classification being then used to classify jobs.

**16. Transfer of Qualified Workers.**—The use of the job specification and record of applications is not confined to the engagement of new workers. It is valuable in passing men from one kind of work to another, from less important to more important work. In many plants, when a desirable man presents himself, it is the practice to find him some kind of work, not perhaps of a skilled character, nor even in the shops at all, with the understanding that he will be transferred to more important work at the first opportunity. In this way a reserve of desirable help is kept in the plant, the records being so arranged that the qualifications of every man are known. Even where this is not done systematically, a full record of each worker's qualifications will often enable the management to put a substitute on work at short notice, by transfer from one department to another. Moreover, such a practice has an excellent influence. The worker feels that he is not tied to his job, but that the firm is looking out all the time to put him forward as opportunity offers. The existence of good job

analysis records greatly helps this procedure.

**17. Example of Applicant Analysis.**—Concrete example will best serve to illustrate the method under discussion. The form shown in Fig. 1 displays certain simple and elementary standards, such as might be agreed upon as a basis for analysis of applicants and jobs. Except as regards age, height, and weight, the entries are all based on the judgment of the person interviewing the applicant. As each qualification is passed in review, a check mark is made indicating the character observed. None of the items require explanation, except perhaps "manual dexterity." The basis for judging this is the simple observation of the applicant's handling of paper, pen, and ink, in filling out his application form. The examples shown are a very elementary illustration of what can be done. The principle is the thing to observe; the method may be expanded in many ways without difficulty. Thus, the applicant's strength may be tested by a machine; a medical examination may show how fit he is

Name <i>John Smith</i>	
Age <i>30</i> Height <i>5'8"</i> Weight <i>150</i>	
Physical Strength	Above <input checked="" type="checkbox"/> Average <input type="checkbox"/> Below <input type="checkbox"/>
Good English	Speak <input checked="" type="checkbox"/> Read <input checked="" type="checkbox"/> Write <input type="checkbox"/>
Apprehension	Quick <input type="checkbox"/> Average <input checked="" type="checkbox"/> Slow <input type="checkbox"/>
Forcefulness	Positive <input type="checkbox"/> Average <input checked="" type="checkbox"/> Negative <input type="checkbox"/>
Patience	Patient <input checked="" type="checkbox"/> Average <input type="checkbox"/> Impatient <input type="checkbox"/>
Personality	Independent <input type="checkbox"/> Average <input checked="" type="checkbox"/> Plastic <input type="checkbox"/>
Manual Dexterity	Deft <input type="checkbox"/> Average <input type="checkbox"/> Clumsy <input checked="" type="checkbox"/>
Special skill claimed:	
Has worked as: <i>Night Watchman</i> <i>Night Elevator man</i>	

FIG. 1

Job <i>Transferring Rolls</i> <i>from No. 14 Vat to Machine</i>	
Dept. <i>F.B.</i>	
Age Height Weight	
English Speak Read Write	<i>Read Tag Instructions</i>
Strength	<i>Handle 300 lb. Rolls</i>
Apprehension	
Forcefulness	
Patience	<i>Careful Adjustment</i>
Personality	
Manual Dexterity	
General <i>Handling Hot Rolls &amp; Carefully Adjusting them in place on Machines</i>	

FIG. 2

for sudden emergencies, or for continuous physical strain; the faculty of apprehension may be observed by giving him a few simple tests, such as the arranging of objects in sequence, the sorting out of mixed objects into designated classes, etc. The observation of manual dexterity can be made in the same way, if desired, but it must not be forgotten that there must be a purpose served in expanding these tests. What this purpose must be will be understood from the articles which follow.

**18. Examples of Job Specification.**—The forms illustrated in Figs. 2 and 3 show how the set of standard qualifications used in judging applicants can also be applied to the analysis of jobs. Where no entry appears opposite a qualification it may be assumed that such qualification is without serious bearing on the work. Thus, in Fig. 2, the candidate must be able at least to read English readily, since he has to obtain his instruction from written documents. Next, he must have a certain degree of physical strength above the ordinary,

Job <i>Tractor Driver</i>	
Dept. <i>Transport</i>	
Age Weight Height	<i>Below 5'5"</i>
English Speak Read Write	<i>Fill out Reports</i>
Strength	<i>Shift and Couple Heavy Trucks</i>
Apprehension	<i>Must be Alert</i>
Forcefulness	
Patience	
Personality	<i>Resist pressure to do work out of turn</i>
Manual Dexterity	
General <i>Previous Experience Desirable but not Essential</i>	

FIG. 3

as he has to handle 300 pound rolls. He must not be of the impulsive type, as he has to take time and patience in adjusting these rolls to machines. It is evident that the applicant recorded on Fig. 1 will fit this work. Another kind of job is analyzed in Fig. 3. Here there is an unusual demand, namely, for a man not over 5 feet 5 inches tall. The reason for this is that he has to take a tractor into a low basement. He must read and write English readily, as he has to make out reports. He must be strong, as he has to move about heavy trucks of goods, to couple them to a tractor. He must be quick and alert, for obvious reasons. He must possess independence of character, so as to resist demands from foremen and others to transfer work out of its turn. Very little observation is needed to show that the man analyzed in Fig. 1 will not fit this job at all.

**19. Purpose Served by Analysis.**—It will now be seen how easy it is to overdo the analysis of applicants. No question should be asked, and no points of character or other qualifications observed or recorded that have no direct



bearing on qualification for a job. Development of the two sides of the analysis must go together, but in the first instance the system must be based on the analysis of jobs. A few data, each of which has real significance with relation to a job, are far more valuable than a number of vague qualifications with no definite relation to any particular job. If this point of view is not strictly observed, the plan of analysis will soon become overloaded with foolish detail and fall into contempt and disuse. It is better to begin with some one simple, clear, and ascertained quality, such as physical strength, and to build up gradu-

1	2	3	4	5	6	7	8	9	10	11	12	13	14
NAME _____							ADDRESS _____						
FAMILY _____				AGE _____		CITIZEN _____		GOOD ENGLISH _____					
NATIVE OF _____				WAGES ASKED _____				WOULD TAKE _____					
LAST EMPLOYER _____							TIME _____						
PREVIOUS EMPLOYER _____							TIME _____						
PREVIOUS EMPLOYER _____							TIME _____						
REASON FOR LEAVING _____							_____						
WANTS JOB AS _____							OTHER WORK _____						
EDUCATION _____							_____						
TRAINING _____							_____						

FIG. 4

ally, than to start a system that will be found useless as the enthusiasm for the new idea wears off.

#### ENGAGING AND TRAINING THE WORKER

**20. Employment Manager.**—The profession of employment manager, or, as it is beginning to be termed, industrial relations manager, is a recent development. It need not necessarily imply any system of job analysis, although in all cases it does imply recording applicants' qualifications. A blank convenient for recording the usual information obtained from applicants is shown in Fig. 4. The tabs at the top of the card

Name _____		Cred. No. _____	
Medical Report No. _____		Accident Report No. _____	
Dept.	Turned	Quit	Dismissed
Reason	Wages		
Extra Earnings			
Absence			
1921	1922	1923	1924
Mar.	Mar.	Mar.	Mar.
June	June	June	June
Sept.	Sept.	Sept.	Sept.
Dec.	Dec.	Dec.	Dec.

FIG. 5

represent trades or skills, such as pattern-maker, fireman, chauffeur, stenographer, bookkeeper, etc. The tabs not applicable are cut away. This arrangement enables two or more tabs to be left when necessary, so that an applicant is indexed under, say, bookkeeper and stenographer, or toolmaker and mechanic, etc. On the back of the card, as shown on enlarged scale in Fig. 5, space is arranged for recording the worker's career in the plant, if and when he is engaged. At such time the application card is removed from the applicant's file and placed in the shop file. The work of the older type of employment man centered round a record of this type. He received applications for help from the foremen and filled them to the best of his ability from the information on file, or, very often, from such applicants as chanced to present themselves on the day of the foreman's application. The more modern type of manager takes control of all the matters mentioned in this Section, except those that are stated to be essentially the business of the executive himself.

**21. Routine of Employment Office.**—The employment manager stands midway between the man who has labor to offer and the foreman who makes use of it. He must therefore have good relations with both. Upon the reception he accords to applicants in the employment office depends a good deal of the workers' judgment of the firm. First impressions are proverbially lasting, and it is worth while considering the impression that a worker will form when he first attends for the purpose of seeking a job. The importance of this increases in proportion as the class of worker is refined and educated. A good or a bad name for a plant may be developed right at the employment office, and spread thence throughout labor circles over a wide area. Nothing elaborate is necessary, but seating space in a plain, airy room, furnished with proper facilities for filling out application blanks, private offices or divisions for oral examination, and a few magazines for those awaiting their turn, will have an excellent effect, out of all proportion to their very small cost. Courteous treatment costs nothing, while brusque, overbearing behavior on the part of a clerk or under-

ling does infinite harm. It requires little effort or sacrifice to treat each applicant as a business man who has something to sell in which the firm is strongly interested. Many of the practices of old-fashioned firms will be seen to be incompatible with this simple common-sense standard. The wise executive will understand that the times are changing, and that in matters like this it costs very little to be abreast of the change.

**22. Training the Worker.**—In perhaps the majority of plants, the various kinds of skill required in the work are developed within the plant itself. The majority of plants, including both large and small, employ more unskilled and semi-skilled labor than they do highly trained craftsmen. A recent development has been the recognition of the fact that it pays for the firm to set up a special department for making unskilled into skilled workers, so far as the special work of the plant is concerned. In some cases separate rooms are provided with the necessary duplicate outfits of machinery, and carefully selected instructors are put in charge. Such men are selected not only for their skill in the work, but also for their capacity to impart that skill to others. The two qualifications do not often occur together in one person. Unskilled or imperfectly skilled applicants are then apprenticed in the instruction department, and they either graduate or fail after a certain time. By this means only reasonably skilled workers are admitted into the shops, and the presence of amateurs does not cause confusion or hold back production. Where it is practicable, this is an excellent plan. Where machinery is too costly, another plan is adopted. A machine in the shop is placed at the disposal of the instructor during certain hours, and the instruction then goes on in the shop. Either plan gives good results, but the separate department is considered the better.

#### COOPERATION OF LABOR IN ADMINISTRATION

**23. Labor as a Corporate Body.**—In preceding articles labor has been considered in its direct relation to work, in particular with regard to the problem of fitting the individual worker to the individual job. The problems now to be approached relate to labor in mass, or more properly speaking, labor in the abstract. Up to this point the discussion has been regarding individuals and their peculiarities. In what follows the subject of labor is to be treated irrespective of individuals, and, in particular, irrespective of what they work at. Employes will be considered all together, as a corporate body, to observe what measures should be taken to preserve the efficiency and to hold the good will of such a body.

**24. Sphere of Cooperation of Labor.**—There are certain functions that are obviously not to be considered as open to labor cooperation. Broadly speaking, decision in all that pertains to the business as business, that is to say, in questions of what to make, and how to make it, must rest on the shoulders of the executive, who is responsible to the stockholders for the efficient use of the capital employed. But when all this class of activity has been separated, there remains a great deal that has much more concern with the labor force itself, than with the product. The physical and psychological conditions surrounding the body of labor are much closer to the workers themselves than to the management, whose attention is perforce fixed on problems of production. It is no doubt for this reason that these factors have been much neglected in the past, and in proportion as labor has found its voice and has become capable of expressing its opinions and desires, improvement has set in. It is natural also that a tendency exists to hand over to labor much of the responsibility for the conditions mentioned, the firm reserving a controlling decision or power of veto. The orderly evolution of future forms of industrial relations depends, perhaps more than is commonly perceived, on developing this new atmosphere in the right way.

**25. Paternalism Versus Cooperation.**—Shall betterment in conditions, that is, physical and psychical environment, come from above, or shall it be encouraged to develop from below? There is probably no general answer, true in every case. It may well happen, especially in the case of foreign labor having low standards of living, that the impulse towards American standards must be generated by authority and guided by supervision. But the matter is a delicate one. Experience has shown that the generosity of the capitalist in providing all kinds of facilities for health and recreation of the laborer is often but little appreciated; the habitual grumbler gets busy with the suggestion that the money had been better expended in paying higher wages. The fact is gifts are little valued unless a desire for them already exists in the mind of the recipient. And what one man thinks another person ought to have is not always what that person is most anxious to have. Almost any one will appreciate an automobile; but if instead he is presented with an equivalent value invested in a well-selected library, calculated to improve his mind, he may not be grateful at all. And a gift that fails to please is worse than no gift at all.

**26. Committees.**—Better than the method of making unsolicited gifts, which always smacks of paternalism, is a plan giving the workers opportunity to air their own views, and to formulate plans for the approval of the executive. This has a two-fold influence. First, it really does insure that improvements actually desired shall receive first consideration; and second, it cultivates a sense of responsibility in the worker, and transfers the target of criticism of the habitual grumbler from the management to his fellow-workers, who are usually capable of taking care of themselves. The customary procedure is to set up committees, each covering some fundamental point, such as safety, sanitation, fire protection, etc. Such committees may be organized in various ways. Sometimes they are made up of officials, sometimes a selection of foremen is added, and sometimes they contain representatives of the rank and file of workers nominated by the management,

or elected by the employees. Perhaps the best start would be made with a nominated committee, drawn from all ranks, and then gradually infused with elected representatives, after a tradition of routine had been established. To start at once with an elective system, where no previous experience of committee work exists, is a dangerous experiment.

**27. Committees as Units of Self-Government.**—It will be obvious that the committee system, once established, and especially when a strong infusion of the elective element is included, is a very flexible mechanism that can be extended until it embraces in its scope the supervision of some very difficult and vexed questions of labor administration. Great care is necessary, however, in the organization of such committees. The dangers of overlapping jurisdiction are just as great here as in the staff organization of the plant. The layout of committee organization should be as carefully conducted as the determination of the responsibility of members of the staff. Nor should the attempt be made to set up a number of such committees at once. Each should become consolidated, and its work appreciated by all, before another is launched. The want of another committee should be felt before it is actually set up; otherwise, the danger of the unappreciated gift reappears. But if judiciously introduced, there can be no doubt that committees are a very valuable means of promoting a sense of solidarity between the workers and the plant. By participating in committee labors, the men begin to feel that the plant is something more than a mere place wherefrom to draw wages.

**28. Psychology of the Committee Idea.**—Almost every person, at any rate almost every educated person, belongs to more than one social class. One man may be but a minor figure in business, but quite prominent in his church or his club. A strong business man may, on the contrary, cut but a poor figure in general society, or may display unexpected ignorance and want of knowledge of the world when he gets up on a platform. This may be put in another way by saying that the faculties by which a man earns his living are not his only faculties, and though his economic value, his earning power,

stamps him as belonging to this or that social class, there are also other cross-classifications in which he may take higher or lower rank. The committee idea is really based on this fact. Because a man is a mechanic or a craftsman of some kind it does not follow that he is *only* a mechanic or a craftsman. He may be a musician, or an orator, or an amateur photographer of skill. Or he may have a head for business detail. In the latter case, the committee forms an excellent field for exercise of this faculty. The defect of the elective system (not only in industrial organizations, by the way) is that the plausible talker tends to get the suffrage of his fellow-workers, rather than the man with the business head. For this reason it seems desirable for the firm to reserve the right of nomination side by side with the elective method. The deficiencies of the latter are thus neutralized to some extent.

**29. Work of Committees.**—The exact scope of the work of committees will depend on the size of the plant and on the kind of labor employed. Where a large proportion of ignorant foreign labor is on the pay-roll, much more caution in admitting workers is necessary than where native Americans are concerned. But, as already mentioned, the representation of the rank and file of workers, though very desirable, and always the ultimate goal to be striven for, is not an essential feature of the committee system. Some of the matters that can be entrusted to committees are the following: Safety; fire protection; sanitation, including lighting, heating, and ventilation; provision of lockers, rest rooms, etc.; first aid, medical service, and hospital facilities; promotion of Americanism, including organization of classes for instruction; promotion of thrift, by affiliation with savings banks, insurance companies, etc.; restaurant and eating facilities. All these are practical matters tending to set up conditions conducive to the comfort, health, and efficiency of the workers, irrespective of the work they do. In addition to these activities, a step further may be made in some cases: part of actual administration may be unloaded upon the shoulders of the workers, where these participate in committee activities.



**30. Committees in Operation.**—In setting up a committee the limits of its sphere of action should first be determined, and set down in writing, and next, the general character of the problems to be taken up by it. These two things together will form what may be termed the charter of that committee. The membership of the committee will then be laid out. Certain officials will have an *ex officio* standing, as, for example, the plant engineer on the safety committee. Others will be nominated either on account of their acquaintance with the subject matter, or because they represent some department vitally concerned. The remainder may be nominated or elected by the workers, or both methods of appointment may be used at once. The nature of the decisions to be made should then be taken up, and the question of referring them to the executive for approval or veto. In connection with proposals before a committee, opportunity should be given for any interested person in the plant to appear, and argue for or against such proposal. Finally, provision should be made for publicity of the proceedings, especially as regards the reasons for adoption of a decision. Where there is a plant magazine, the proceedings of committees will form part of its news.

**31. Finance of Committees.**—Most committees, as, for example, those dealing with safety, sanitation, fire protection, and so forth, will to a certain extent control the spending of money. Unless their work has a practical aim, that is, is directed to getting definite things done, interest will soon die out. But to get things done involves, naturally, the spending of money. From an educational viewpoint this is also an important matter, where the workers participate in the discussion. The best method of procedure is to allot a given sum per annum to the committee. In other words a committee budget is prepared, the share of each committee being defined and limited. The amount to be allotted may be estimated from the amounts spent in previous years on the same class of work, with proper allowance for special conditions. Thus, in a plant in which safety appliances had been neglected, the amount spent in previous years would be no guide. But, generally

speaking, a fixed budget should be made up, and the committee should be given to understand that this must not be exceeded. From the outset, with the working of such a committee, practical education of its members begins. There will probably be a number of reforms to be made, and the necessity of choice, the importance of so spending the money that the utmost benefit is derived, will be a good object lesson. There is no one so glib on the subject of the capitalist's sins as the man who has never controlled the spending of twenty dollars at one time. To such a man ten thousand dollars is as big as any other sum, until experience proves that it is not.

**32. Devolving Administration on Committees.** Perhaps the most elementary type of committee is that which deals with rules and regulations. In many plants insufficient attention is given by the executive to the control of rules and regulations. Many plants are plastered with notices, forbidding this or that, often worded with unnecessary violence, and threatening penalties beyond the needs of the case. Where minor officials are permitted to make rules this condition is generally found. The natural result of a multiplicity of arbitrary regulations is that after a short period of enforcement, they are presently disregarded and no one takes any further notice of them. As an alternative to this state of affairs, the work of a committee on rules is a great advance. Rules may be offered by the management or by any worker; opponents may be heard, and the necessity for a rule discussed. It will sometimes be found desirable to change both wording and spirit. But when adopted and approved by the executive, a rule so promulgated by a committee has the best chance of usefulness. The regulations should be printed as a vest-pocket volume, and a copy given to each new worker on engagement. Rules relating to particular place (as elevators) should be posted up at that place, but always as an extract from the official rule book, giving page and number reference, and signed by two members of the rules committee, one representing the management and the other the workers.

**33. Further Devolution of Administration.**—Many plants have developed the devolution of administration functions on to committees much farther than this. In certain factories where piecework is the rule, the work of fixing a piece price satisfactory to both management and workers has been placed in the hands of a committee, with satisfaction to all concerned. In such cases, provision is made for arbitration by a third party, connected neither with the management nor with the workers, in case of failure to agree. It should be understood that a committee is bound by definite rules in making its decision. Rates are not changed, except on demonstration that they are incorrect. Changes of rate accompany changes of method, but the new rates are on the same fundamental basis as the old. The committee has nothing to do with rise or fall of the general level of wages. It is, in effect, making price-lists, which may be subject to discount or increase according to the general condition of trade. These latter adjustments should arise from another source altogether, that is, by agreement between the management and the workers, brought about by a special conference or other exceptional means. Under no circumstances should a rate-fixing committee have anything to do with general wage rates, or confidence in its justice will soon be lost.

**34. Summary of Committee System.**—Enough has now been said on the question of committees to show the general principle on which they are established, and the nature of the problems with which they may deal successfully. It may be added, however, that the so-called welfare work, which includes the provision of recreation facilities of all kinds, should be developed through committees, each allotted a definite budget, rather than through paternal officials. Though some efficiency may be sacrificed by this course as regards the swift attainment of a given standard of success, the loss will be more than made up by the fact that the result will be a natural development in which the workers feel they are taking a good share of responsibility. The resulting structure will, in effect, be regarded by the workers as theirs by right, rather than as an unasked-for

gift from the management. At the same time, in adopting this course, a self-governing atmosphere is being built up in the plant, which, if skilfully guided, should eventually lift a considerable burden from the shoulders of the management. The work of management is to make goods, and only secondarily to govern men. If the latter can be encouraged to govern themselves, even though only in part, so much executive energy is saved for the true work, namely, getting out product.

#### THE EXECUTIVE AND WAGE RATES

**35. Labor Policy of the Executive.**—It has already been remarked that successful relations with labor depend to a very great degree on the personal reaction of the executive toward the whole subject of employment. Even where all the mechanisms described in the foregoing pages are in successful operation, there will still remain a number of matters that cannot be devolved on other shoulders by the executive. One of these is the subject of wages, both for classes of labor and also for individuals. There may, for example, be a well-recognized wage rate in the plant for a certain kind of work; and there may be, also, certain individuals in that class who are very skilled and experienced in it, without possessing any great qualifications for better-paid work. Yet the pay of that class may not be entirely adequate for their wants. What is wanted in such case is a guiding rule for action, because an arbitrary exercise of generosity in favor of an individual does not tend to make for peace. How, then, are wages fixed? What is the guiding principle?

**36. Factors That Fix Wage Rates.**—How does it come about that one man makes more than another? In every industry there are commonly a considerable number of standard wage rates, officially recognized. How were these fixed in the first instance? The one prevailing method of wage fixing is by trial and error over long periods of time. All the great standard trades have had their remuneration fixed in that way. Generally speaking, the amount will depend (a) on the amount of

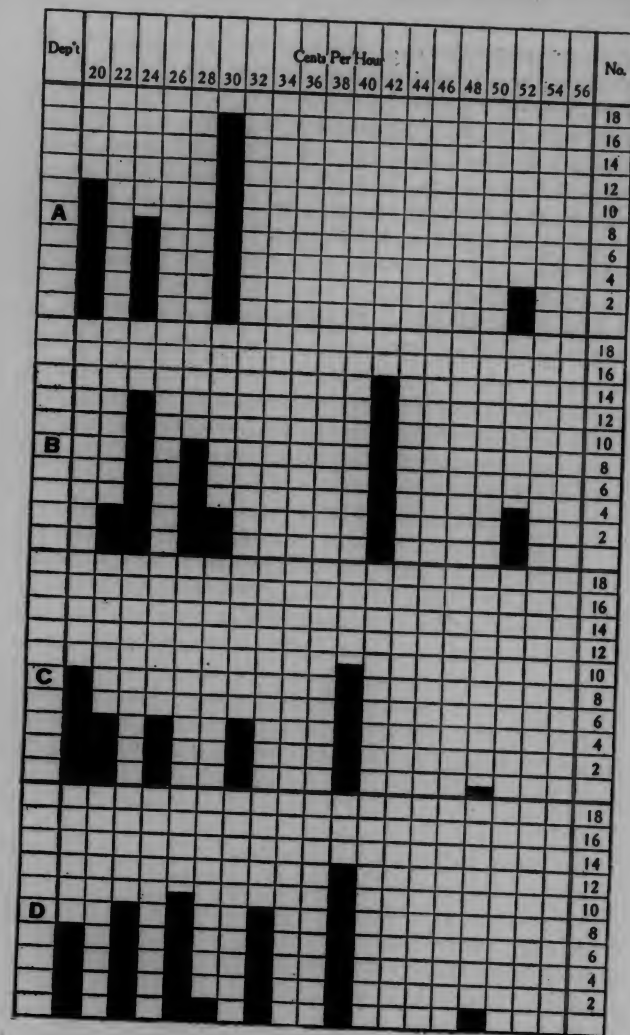


FIG. 6

preliminary training, apprenticeship, etc., that precedes the period of fully fledged craftsmanship, and (b) on the character of the employment, whether regular or seasonal. High wages for a short season compare favorably in the long run, with lower wages earned uninterruptedly throughout the year. In the older trades, tradition, qualified by recurring struggles to maintain or increase the rate, have set the standard wage. Wages in the main represent a reward sufficient to draw aspirants into the occupation, under the existing conditions of training period and employment. In modern plants the larger proportion of the workers are engaged in occupations of modern origin, and requiring but a short period of training. Yet each such occupation may require a different degree of intelligence. Thus, there arises a third factor of wage standards: (c) the wage must suffice to attract the right type of worker.

**37. Standardization of Wage Rates.**—It frequently happens, especially in plants that have grown rapidly, that the wage question is in a state of confusion. Fixing rates has been entrusted to foremen, or has been done in a hurry to meet some existing emergency, and as a result, all kinds of prices are being paid for the same work. The first step in putting wages on a standardized basis is to make a survey of wages actually paid in the plant. Fig. 6 shows a chart on which such results may be tabulated. The vertical columns represent wage rates in cents per hour. In each column is marked a heavy black line, corresponding to the number of persons receiving that rate. Thus, in department A, twelve are shown as receiving 20 cents; nine 24 cents; eighteen 30 cents; and so with the other departments. Summarizing the results, it is seen that twelve different rates, varying from 20 to 52 cents per hour, are in regular use. No light is thrown on the reason for this multiplicity of rates, but inquiry will probably show that, within limits, it has but little relation to differences in function or skill. The two highest rates will probably be an exception, though there is probably no good reason for the small difference between them.

**38. Individual Loading of Standard Rates.**—In each plant there will be certain individuals who deserve well of

the firm, apart from the class of work they perform, or the trade skill they exercise. In addition, therefore, to the elements of rate determination already mentioned, a fresh element must be added, expressing this special relation of the worker to the plant. Length of service is one of the elements that deserves recognition in this way. A faithful, settled employe is worth more to the plant than one of equal skill who is likely to leave at any time. Consequently, in addition to the survey of rates, a survey of length of employment should be made. A chart that can be used for this purpose is shown in Fig. 7. This refers to one

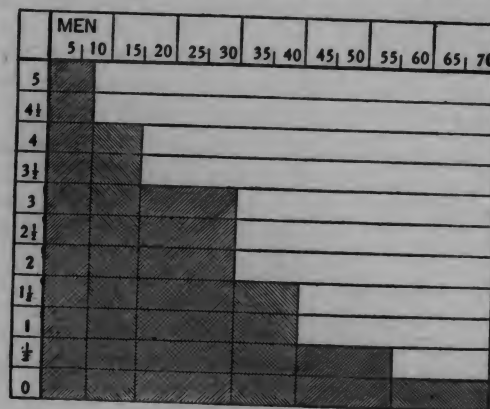


FIG. 7

department only, but a similar chart may be used for consolidating the information for the whole plant. The horizontal scale represents number of men employed. The vertical scale represents completed years of employment. Thus, 7 men have completed 5 1/2 or more years (the scale does not extend beyond this); 8 men have completed 4 1/2 years; 15, three and a half years; 10, two years; 15, one year; and 15 only 6 months. This would be a very good showing for a plant in these days. The problem now is, how to load the rates for each class of work so that something extra may come to the individuals in proportion to years of service.

**39. Using Percentages for Loading Rates.**—Not only length of service needs to be taken into account, but in some cases what may be termed special service. Thus it may be known to the management that a certain individual has an excellent influence in the shop, that he is a peace-maker, or perhaps a foe of trouble-makers. To hold to the concern a man with deep-seated feelings of loyalty is very desirable on all grounds. Yet such a man may happen to be of the type that is not cut out for responsibility, and cannot be advanced to more important positions. That is, his moral value may be high, while his economic value is not above the ordinary. In any such case a loading of the man's earnings is desirable. The way in which this loading may be done is by the simple device of granting a percentage increase above current wages. Thus a man may be receiving \$30 a week normal wages, and may be down on the special pay-roll for an additional 1 per cent. or 10 per cent., as the case may be. Whatever his earnings as a worker, he gets this additional percentage of them as an individual. This expresses the firm's valuation of the relations between this employe and the management. The percentage for length of service may be graded, say, 1 per cent. for each year completed. Special service cannot be so graded, but as the man to whom it is awarded will probably receive a service percentage also, this latter can be increased. By this arrangement, wage rates and special increases for reasons apart from production are kept distinct.

**40. Wage Rates and Cost of Living.**—The percentage method of distinguishing between real wages and extra payments due to special conditions was adopted by many firms during the disturbed period that ensued after the great war. Pay slips showed that the pay was calculated in two amounts: (a) ordinary standard wages and (b) an extra payment on account of the high cost of living. It is possible that the germ of a very valuable system for future adjustments of the wage situation may be found in this. Economists publish regularly certain statistical data called index numbers, which indicate the rise and fall of the principal market prices of food and



clothing. There seems no reason why industrial wages should not be continually adjusted to these changes by means of extra percentages, so that strikes for more pay on that account would have no moral excuse. Such an arrangement is called a *sliding scale*. It is followed in some industries, as in the English cotton-spinning trade, but is there based on the market price of cotton goods instead of the cost of living. For some thirty years it has proved an automatic method of avoiding wage disputes. The matter is not, however, one of practical application at this time, and can only be adopted by common agreement between employers and workers in a whole industry. It cannot very well be introduced by one employer alone.

**41. Promotion of Workers.**—A good deal of confusion of thought exists with regard to the relations between normal wage, special increases, and promotion. There are, in fact, two sides to this question—that taken by the employer, and that taken by labor as a body, especially by organized labor. The employer is apt to think in terms of the individual, since he has to live with the individual. Labor thinks in terms of the class or body of workers of any given kind. This opposite viewpoint often leads to trouble. The employer points to promotions as an answer to claims that workers are being underpaid. He shows how Jones, who began as a laborer, is now getting \$2,000 a year. Why this does not satisfy labor he cannot see. Nor can labor see how and why it is expected to give any discount on account of Jones's success. Promotion is an affair of individuals. Labor as labor is never promoted, except perhaps, when a whole class of work is raised to a higher wage rate. Labor, as such, is interested only in the latter kind of transaction.

The question of promotions really has no relation to labor problems as such. The same statement applies to the transfer of workers from one class of work to another and better-paid class. This is an individual matter, and affects neither the wage rates of the class from which the man came, nor that to which he goes. The distinction between the process of promotion and the problem of wage rates should remain quite



FIG. 8

clear in the mind of the executive. Special increases are also a species of promotion, being individual to the worker, and so must be kept entirely separate from the general wage-rate question. Wage rates should be standardized on their merits, and nothing but the skill and qualifications demanded should be expressed by them. Under such circumstances they will probably vary between but narrow limits, except in the case of piecework, which is again an individual matter depending on a man's adaptability to his job beyond the average.

#### REPORTS TO THE EXECUTIVE

**42. Reports and Returns for the Executive.**—There are several matters relating to employment on which the executive will do well to keep watch. This can be done by organizing a series of reports, preferably in the form of charts, to which attention should be given at regular intervals, once a month being usually sufficient. Among the matters that should be studied in this way will be: the actual turnover of labor in each department; the quantity of time lost by reason of sickness, absence, and accident; the proportion of English-speaking to foreign employment; and, where piecework is in operation, the ratio between standard wage and total earnings of pieceworkers. To illustrate the principle of these monthly reports, specimens will now be given and their working explained.

**43. Labor Turnover Chart.**—A graphic representation of the labor enrolment and turnover may be drawn up in the manner shown in Fig. 8. The figures for an entire year are shown, but in practice the chart is made up month by month, and is examined at the end of each month, so that the current month's record is compared with the records of preceding months. Squared paper is used, but in the diagram here reproduced the squares are omitted to avoid confusion in detail. The bands and lines are, however, drawn to scale, except that the scale of the two lightly shaded marginal bands is arbitrarily made five times as great as that of the darkly

shaded central band. This is merely a matter of convenience; if the same scale were used throughout, certain features would be too small to show at all. The width of the darker central band represents (to a suitably chosen scale) the actual (average) labor enrolment each month, that is to say, the average number of men on the pay-roll during that month. The band in lighter tint above represents, on a scale five times as large, the number of men newly hired during the month, and a light band below similarly represents the number of men leaving during the month. The corresponding percentages, based on the enrolment for the month, are also shown in figures above and below on the chart.

The chart displays the conditions in two different departments, *A* and *B*. It will be seen that department *A* is carried on with a much smaller turnover of labor than the other; also that the seasonal drop in employment after June hit the two departments in a different way. Thus, at a glance attention is called to several important facts about employment in the two departments. In an arbitrarily chosen example like this these facts may not carry much conviction, but in practice as applied to work with which the executive is familiar, they would be of very great interest. Anyway, the different amounts of turnover in the two departments would suggest further inquiry into the situation.

**44. Percentage Charts of Special Classes of Labor.** The chart in Fig. 9 exhibits, month by month, the ratio of English-speaking workers to those unable to speak English. A separate chart is prepared for each department, and the totals for all departments can be consolidated on a similar chart. The variations from month to month are easily read, and are especially useful when some change of policy has been determined on, such as, for example, the reduction, as far as possible, of the percentage of non-English speaking workers to a certain level. The same type of chart will serve to exhibit other facts on a percentage basis. Thus, instead of language, color may be indicated, the chart being drawn so as to exhibit the proportion of white to colored labor. Or, it may be drawn by nationality,

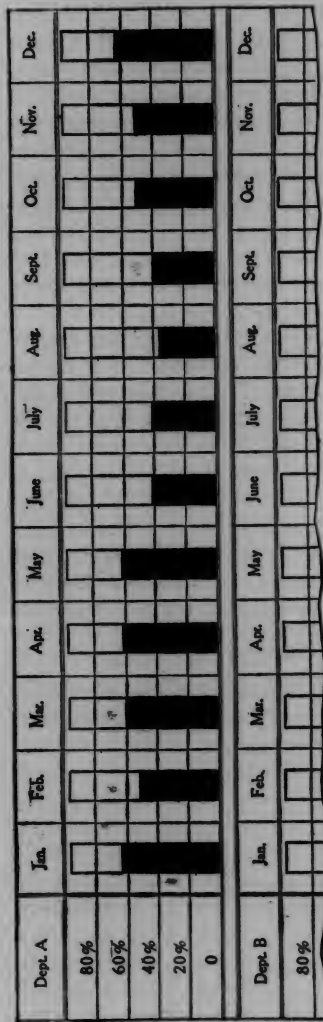


FIG. 9

showing the percentage of aliens to Americans. Whether or not any of these classifications may be worth exhibiting depends entirely on local circumstances. In some cases they may be of great interest, in others, not worth compiling. The test of all such data is whether useful information leading to some practical end can be drawn from them. One more use may be mentioned. If several colors are used to represent nationalities, instead of two simple percentages in black and white, the detailed composition of the working force by nationalities may be indicated; for example, 20 per cent. Americans, 30 per cent. Poles, 40 per cent. Italians, 10 per cent. miscellaneous. Many plants employing foreigners like to control the admixture in the shops. This form of chart will give the executive quick information as to whether the policy is being observed.

**45. Sickness and Accident Charts.**—Another type of chart is

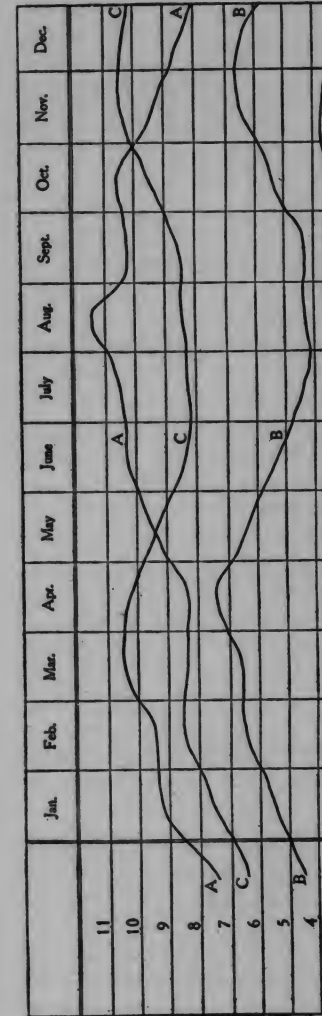


FIG. 10

shown in Fig. 10. This type can be used for various purposes, but in the specimen illustrated, the number of man-days lost to the three departments A, B, and C, are charted. The cause of the lost time is assumed to be sickness plus accident. Separate charts could be plotted, one for each of these causes, if desired. Where accidents are at all frequent this should be done. In a non-dangerous trade, however, the loss due to accident would probably be insignificant. The way to calculate the loss in man-days is to total the hours lost by all individuals, and then divide by the number of hours in a working day. Thus if the working day is 8 hours, and a total of 84 hours has been lost in any month, then the loss is  $10\frac{1}{2}$  man-days. By plotting the various departments, each in a different color, alongside one another, the conditions in the several departments can be compared. Where a

single consolidated chart of all losses is ordinarily considered sufficient, if the amount in any one department seems unduly high, the figures should be subdivided, and separate charts drawn for that particular department, so that the individual causes can be isolated. When remedies are applied, their influence in reducing the loss can then also be plainly followed on the charts thus subdivided.

**46. Ratio of Piece Earnings to Day Wage.**—The type of chart shown in Fig. 9 will also serve to plot the ratio between the total earnings of the workers in any department and their standard day wage. Such charts may represent the aggregate of all workers' earnings in a department. Thus, the black column may be plotted so as to express the proportion of wages to total earnings, leaving the white portion to represent the piecework balance. If there are twenty men in a department, whose full day wages per month amount to \$125 each, this gives a monthly aggregate of \$2,500 for the day wages of the department. Now, if these same men have actually earned \$3,000, the black column will be plotted to show 83.3 per cent. of the total as day wage, and the remainder, or 16.7 per cent., will represent the ratio of piecework profit to the total earnings. Singly, such a fact is of little interest or value, but as in the case of all charts and reports of similar character, it is the facility of comparison between the present and previous periods, and of one department with another, that puts significance and value into the statistics. Although piecework is, as mentioned above, an individual matter, yet the general results of piecework as regards the labor working under the system have considerable influence on matters of labor policy, and for that reason the chart is here included.

**47. Conclusion.**—There is probably no phase of industrial management that is undergoing such rapid and fundamental changes at the present moment, as that which is concerned with the relations between employer and employee. It is therefore peculiarly difficult to treat this topic in a manner that will be of permanent benefit to the reader, inasmuch as practice is not settled, and many of the ideas now being tried out are

only in the experimental stage. In a general way, however, what has been set forth here will be found to cover the essentials, if the limitation pointed out is kept in mind. The old order of things, in which the executive was in close touch with individuals he employed, has almost passed away, and the new order has not yet settled into a fixed form. Between direct personal relations and those outlined here, there is obviously a great gulf. The one danger that overhangs the new methods is the introduction of the deadening influence of bureaucracy, in which some clerk or other is invested with inquisitorial powers, or acts as if he were thus invested, and so creates an atmosphere of dislike and distrust very difficult for the executive to discover. The cautious development of the committee system is perhaps the true line of progress, because it alone provides a regular route for the workers to express their desires and opinions without fear. Many employers pride themselves on being accessible to complaints from the most humble of their employees, but in practice this appeal to Caesar is apt not to work in just those directions in which a safety valve is most required. It is often the small things that irritate most, and for these the committee system seems to offer the fairest promise of successful handling.

#### EXERCISES

- (1) Indicate what should be done in placing an employee who is found to be handicapped by: (a) a technical defect; (b) a defect in character.
- (2) Explain what is meant by the psychological environment, and how it interests the executive.
- (3) State some of the fundamental conditions which a system of analysis and analysis of applicants must satisfy.
- (4) Show some of the advantages gained by the institution of workmen's committees, and point out some activities to the control of which this system is particularly well adapted.
- (5) (a) What is meant by *loading* wage rates? (b) Why is it desirable to have a definite system by which to determine the loading of the wage of any particular worker?
- (6) Why is paternalism an undesirable policy in dealing with labor?



(7) Indicate reasons why it may be desirable sometimes to engage the services of a man although no immediate vacancy exists in which his aptitudes can be used to advantage.

(8) (a) Should appointment to workmen's committees be made by election or by nomination? (b) In whose hands should rest the power of election or of nomination? The answers to these questions should state reasons in full.

(9) In the labor turnover chart, Fig. 8, why are the lightly shaded bands drawn to a larger scale than the darkly shaded band?

(10) (a) Indicate in what respect the purchasing of labor should be carried on according to the same principles as the purchasing of any other commodity. (b) Indicate also in what respects this purchasing of labor calls for special considerations that do not ordinarily enter into the handling of other purchases.

## CHAPTER VIII

### PROMOTION OF QUALITY AND QUANTITY

#### INTRODUCTORY

**1. Quality and Quantity.**—It might perhaps be supposed that in industrial operations there is a certain conflict between the production of quality and quantity; that quantity can be pushed only at a sacrifice of quality, and that in practice a compromise must be made. While this may be true up to a certain point and in certain particular matters, it is very far from being generally true. On the contrary, the rule is rather that improvements in quality go on at the same time with, and as a necessary condition for, speeding up on quantity. This statement, perhaps, requires a little explanation.

**2. Secret of Quantity.**—Efficiency in industrial operations of a routine character is based on repetition. Product is made up of parts on which numerous operations have been carried out. It will hardly be denied that if each successive lot undergoes precisely the same operation, the uniformity of the product will be at a maximum. All industry tends toward this ultimate condition. Every year sees productive processes made more exact, inspection more rigorous, the limits of variation in process work reduced. Can it be said, therefore, that production is thereby being made more difficult year by year? The contrary is true. All this precision makes pro-

duction easier, because it makes each aim more definite and precise. Yet it may also be said that all the time quality is being increased, since the limits of error are being made less and less. As a practical matter, then, it would seem that industry has found out that the secret of quantity is, first of all, quality.

**3. Habit Formation.**—Whenever it is necessary to repeat an operation hourly, daily, and continually, what is termed habit is formed. The tendency is to do the same thing in the same way, time after time. Now, a habit can be acquired in either of two ways, namely, consciously or unconsciously. It can be formed by conscious imitation, attention to instruction, or self-teaching. It can also be formed unconsciously, without any realization of its origin. Industrially, both of these types of habit formation have always been relied on rather indiscriminately. Under such conditions there is no assurance that the habit formed is really the most advantageous. A modern discovery is that the industrial field, to say nothing of others, is full of exceedingly poorly designed habits. Methods and routine that have been found good enough for years, or even centuries, are, when analyzed, found to be improvable by a large margin, with gain to everyone concerned.

**4. Discoveries Made by Analysis.**—The discovery of remarkable margins of inefficiency in many industrial fields has been made, not by ordinary observation, but by the application of new methods of analysis to operations. Time study, motion study, and fatigue study are the methods by which light has been thrown on the efficiency of routines of all kinds, and particularly on those in which recurrent or constantly repeated manual operations are concerned. It has been found that industry is full of unnecessary movements, and as each movement, whether directly contributing to the desired result or not, expends nervous energy, it follows that the elimination of unnecessary movements increases the total production without throwing any greater strain on the worker. The subject of fatigue also has been studied analytically. The saying, "A change of work is as good as a rest," if not abso-

lutely true in all cases, has been found to be at least very near the truth. The principle is that strain on one set of muscles or of nerves gives rise to fatigue of that set in particular, without necessarily affecting other sets very much. If time is given for the local fatigue to be dissipated by short rest periods, it is found that greatly increased output is the result.

**5. Sphere of Time and Motion Study.**—While the principal sphere of application of time study has been, and probably always will be, the factory, the same method has also been applied to other departments of business; it can be used wherever a series of steps have to be taken to produce a result, and may be applied either in a broad way or to ultimate detail. Thus, the operation of packeting and casing a product may be under investigation. First, a broad analysis is made by dividing the routine into its main and obvious divisions, say, wrapping, labeling, sealing, placing in cartons, putting in cases, pasting down case lining, and putting on and nailing lids. The average time taken in each of these main divisions of the work is first ascertained and tabulated. Then each one of these divisions is attacked in detail. That kind of time study which is termed motion study now comes into play. Every movement made by the hand of the operator is followed, and its duration timed. Then the processes are discussed and made the subject of experiment, with the definite object of producing the same end in fewer motions. Some of the motions that originated in unconscious habit will usually be found unnecessary and will be eliminated. Then the operator is carefully instructed in the newly designed movements, and practises them till they become automatic. Thus a new revised habit is formed.

**6. Routine Histories.**—There is also another field in which modern analysis is applied. Where there is a cycle or round of operations, it is very serviceable to study and chart the time taken by each step in the cycle. For example, a chart can be constructed to show graphically the time taken to repair a steamship after the voyage, how long the ship

waited for its turn at the dock, how long the loading process occupied, how much time was spent on the voyage, in waiting for dock, in unloading, coaling, reloading, etc. Such a chart, compiled once for one ship, would perhaps not yield much information; but when regularly applied to a fleet of ships and to a variety of ports, the chart will bring out very clearly the influence of local conditions, time lost from various causes, etc. The information so collected and charted may be a guide in shaping the policy of the shipowners in the selection of ports of call, location of coaling facilities, type of ship for certain purposes, and other points that will easily come to mind. The *quality* of a shipping service may be considered its speed, safety, and reliability; the *quantity* is measured by the tonnage carried in a given time. A study or analysis of this kind discloses the factors that are favoring or hampering quality and quantity. Once these are charted so that they can be compared, conditions for improvement have been established.

**7. Correlation of Quality, Quantity, and Remuneration.**—If, as has been said, the application of time, motion, and fatigue study gives rise to better and more economical ways of doing work, it follows that a new fund, namely, that of the savings so made, is available to enlist the cooperation of the workers. It will be found, therefore, that the question of these new methods of analysis is closely associated with methods of remuneration. Actually, the endeavor to find a solid basis for adequately and safely remunerating the worker in proportion to the merits of his work was the original impulse that led to the development of these new methods of analysis. It must not be forgotten that such methods are often very disturbing to the worker. No one likes to have his cherished ways of doing things disturbed and proved wrong, particularly when the disturbance comes from persons that are, as far as he is concerned, outsiders. It is therefore no more than fair that the worker should benefit from the economies secured. A large number of special systems of remuneration have been developed of late years, each of which in turn has been heralded as settling the labor difficulty once for all. These claims are, for the most

part, illusory. Piecework, premium, bonus, and similar systems have a family likeness when analyzed, and all have about the same effect. Some, however, are more applicable to particular conditions than others.

#### PERFECTING PROCESSES AND ROUTINE

**8. Where to Begin.**—When introducing new practice by the method of analysis, great attention should be given to the personality of the men who are to undertake the work of reform, especially if they have had no very extensive experience of the same kind in other places. Much tact is necessary to avoid arousing a spirit of antagonism. In the popular phrase, the idea should be sold to the workers before it is put into active operation, that is to say, the workers must be shown that it will work to their financial advantage. Moreover, the first attempts should be directed to some comparatively unimportant work. The very contrary is apt to be the course adopted. The most important and the most promising field is liable to be selected for the first experiment, with the result that if anything goes wrong (and in inexperienced hands something usually does), the whole method is blamed, and a condition of general discouragement or enmity is set up. Some unimportant division of the work should be first experimented on, so that experience may be acquired, errors of procedure rectified, and the method of presenting facts learned, before really important work is interfered with.

**9. Making a Time Study.**—The principle of time study is the resolving of the work into its separate stages. The first thing is to distinguish the most important stages. Thus, in the case of a machining operation, there are certain natural stages that can be plainly recognized. A piece of work has just been completed on a milling machine, say the old work has been removed from the machine table. The new piece is on the floor at hand. What are the natural stages, the large, main stages, which it is desirable to distinguish, and for which it is desirable to ascertain the separate time occupied? First,

the preparation of the machine. A new cutter is required. The old one has to be taken out, and the new one placed in position. Next, the new piece will probably require its appropriate jig or holder to secure the work on the table of the machine. This done, the work has to be lifted from the floor and secured in the jig. The cutter is then adjusted. All being ready, work commences and continues until the job is finished.

**10. Timing the Stages.**—Now, suppose that it is desired to make an elementary time study of the operations just described. By means of a stop-watch the actual time occupied by each maneuver is recorded. A large number of observations are made, and an average is taken over the whole series. A single observation would be subject to all kinds of errors. The worker might have a stiff arm. He might be unusually slow through not being up to par in health. Accidental circumstances might interfere, some little maladjustment might cause the cutter to stick or the jig to refuse to fall into line as required, for inanimate things have their moments of contrariness. It is not the exceptional case that is wanted, but the average of a number of cases. When, therefore, a sufficient number of instances have been observed, the observations can be charted and conclusions can be drawn from them. It should always be remembered, however, that nearly all statistics become important in proportion to the degree to which they are comparable with other statistics. Isolated sets of observations may teach something, if interpreted in the light of experience, but there must always be the experience, or its equivalent, at hand.

**11. Charting the Observations.**—A chart recording observations made in a case similar to that just cited is shown in Fig. 1. Each division of the scale represents one minute of elapsed time. Observations commenced with the removal of the old work from the machine table. The results of the observations are so clearly shown on the chart that they need not be recapitulated, but it may be interesting to consider the lessons such a chart offers. The first thing that will strike the observer

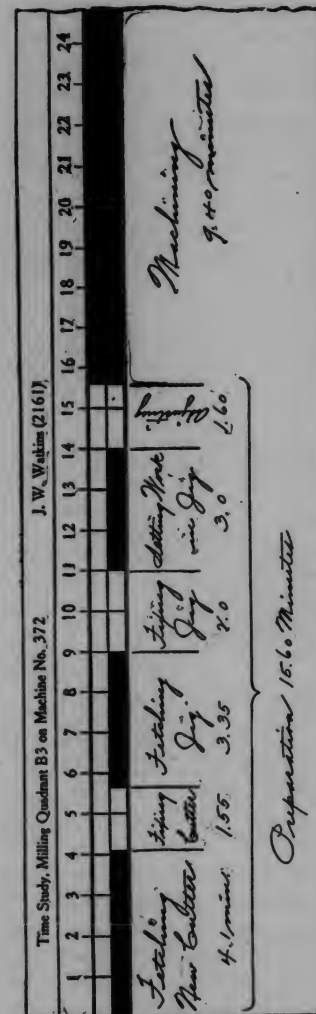


FIG. 1

is that, while actual machining time on the job was about nine and a half minutes, preparation time occupied no less than fifteen and a half minutes. Then it will be noticed that out of this latter time, no less than seven and a half minutes was taken up by the necessity of finding and bringing the necessary tackle, namely, the cutter and the jig, to the machine, while a little over eight minutes was occupied in setting up the work and adjusting the tools. If the chart reproduced represents average conditions in the operation under discussion, it is clear that the percentage of preparation time is too high, and within this allotment, the percentage of fetching and carrying time is again too high.

**12. Features Revealed by Time-Study Chart.** To any one whose contact with practical factory work has been confined to a modern, well-organized shop, the facts disclosed by the chart illustrated may, possibly, seem fanciful. As a matter of fact, they



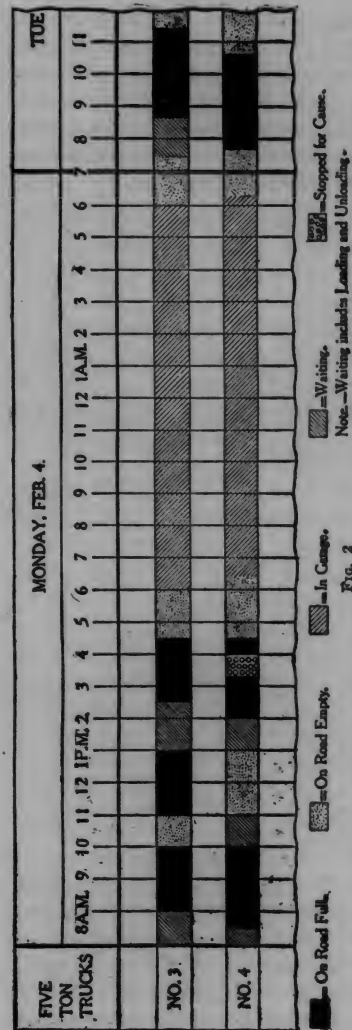
represent what not so very long ago was an average condition in all but the best managed machine shops. The old-fashioned factory superintendent had a positive horror of what is termed indirect labor. He hated to see on his pay roll any but names of actual workers. Consequently, all the work of preparing, fetching, and carrying tools and fixtures, and even in many cases the moving of the work itself about the shop, was put on the shoulders of the operators. Work that could have been done by unskilled labor or by boys was performed by high-rated men. This was wasteful, but it was not the worst feature. It has repeatedly been pointed out that it is only by operation that the factory earns money. In most plants operation means machine operation. Now, under the conditions revealed by the chart in Fig. 1, it is evident that the machine under observation was doing actual work only  $37\frac{1}{2}$  per cent. of the time. That is to say, for  $62\frac{1}{2}$  per cent. of its time the machine was standing idle and not earning money for the firm. What steps should be taken in this case?

**13. Remedying Shortcomings.**—In seeking to improve the conditions represented by the chart, in Fig. 1, the first thing to be reduced is obviously the time spent on fetching the necessary equipment. Further studies may then be undertaken to ascertain the aggregate amount of time taken up by the various operators in doing this class of work. It will probably be found to amount to the day's work of two or more men. This being the case, the question will arise whether it will not be better to assign special men for this work, such men being less highly rated than the machine operators. Proper tool rooms will probably be installed, so that every auxiliary device can be found at a moment's notice, and a service organized whereby the tools are brought to the machines at the same time as the new work, or shortly after. This done, a working-time increase of 30 per cent. will already have been made in the earning power of the machines. The next step is to study the time occupied in fixing, setting, and adjusting work and tools on the machine itself. This is a technical problem. It may

be desirable to make a further analysis of these steps, in the way of motion study. Then, in the light of this new analysis, the engineering division may be able to make improvements in the jigs, in the tool holders, in the way in which work is placed on and taken off the machine table, and so forth. Whether or not this can be done depends on technical conditions and is not a matter of better organization.

**14. Analysis the Way to Improvement.**—In the case just described, it will have been seen that conditions may exist in a plant which are in fact very bad, but which escape attention for the reason that every one is accustomed to them. Ordinary observation would not reveal the existence of such conditions. The most elaborate cost accounting of the old kind would not indicate the great inefficiency that exists. It is only when a systematic study of the situation is undertaken, and when the different steps of operation are gone over minutely and analyzed, that sufficient and sure knowledge of the situation is obtained to serve as a guide in remedying the defects. Time and motion studies are only a special case of close, minute, and detailed study of a set of facts. There is no magic in such studies, although they frequently lead to very unexpected disclosures. They represent ordinary physical and mental processes applied in a methodical way to the examination of certain kinds of problems. If this is remembered, time and motion study will be seen to have a wide scope of application; at the same time any tendency will be avoided to regard them as cure-alls by which to raise general efficiency by a twist of the hand, without any complementary steps on the part of the executive. Time and motion studies are only tools by which the executive may find out the actual truth. When found, it has still to be faced and acted on.

**15. Charting Cycles of Operations.**—It was mentioned in an earlier article that time study can be applied usefully to recording the routine history of work that is performed in cycles. Thus, the daily performance of a fleet of motor trucks forms a cycle that is very readily studied in this way, as illustrated in Fig. 2. In practice different colors would be



used to distinguish the different phases of the cycle, giving clearness and precision that are lost in the black-and-white reproduction. The time scale at the top of the chart represents the day of twenty-four hours, beginning at 7 a. m. and ending at the same hour next day. The chart is plotted from a recorder carried on each truck, supplemented by the driver's report. As shown, the following conditions are distinguished: In garage; on road, empty; on road, loaded (heavy black line); waiting, which includes loading and unloading; stoppage for cause, which includes breakdowns. Trucks are earning money only when they are on road, loaded. Consequently the proportion of the heavy black line to the complete cycle is the interesting thing. All the other readings are in fact explanations why this heavy black line is not longer. It is therefore these explanations that must be studied, if an increased length of the black line, that is, increased

actual performance is to be attained. Not much information can be drawn from a single chart. The chart, as shown, if it represents average conditions, suggests the following action: Means should be developed for quicker loading and unloading; return loads should be arranged for where there is too high a proportion of road work without load. Further analysis can be made of certain items. Thus, the item *waiting* can be further analyzed into loading, unloading, waiting for load, waiting turn to unload, etc. Remedies can then be attempted with a full knowledge of the facts.

**16. When to Apply Analysis.**—The new methods of analysis are not confined to the examination of mechanical operation. They can be applied equally well to hand operations, even to such matters as the handling of papers by a stenographer or a typist. Wherever there are operations made up of steps, or of separate motions, a close analysis is likely to reveal that some of these steps and motions are unnecessary or can be modified. Common sense is necessary to secure economically profitable results from such analysis. Time and motion studies are costly, and can be profitably applied only to such work as is repeated in identical routine day after day. If the executive will remember that the general effect of the reforms to which the way is pointed by time study is the formation of new and better habits, he will be able to distinguish between what is profitable and what is not. A field in which a particular set of operations is so infrequent that the new habit would not get continuous exercise is best left alone. Common, everyday work, on the contrary, is the most profitable field, because there the new habit has continuous and frequent exercise, and can become fixed in a short time.

**17. Fatigue Study.**—Fatigue study is as yet in a somewhat undeveloped condition and can hardly be undertaken with advantage save by experts with special training. Space will not permit of any description here of the methods employed, but it may be pointed out that there is open to the executive one means of participating in fatigue study, and that is by the rough method of trial and error. In other words, where

conditions seem to demand it, experiment can be made with the introduction of rest periods. Such experiments should be very cautiously made, and the periods meted out with a niggard hand, since it is far easier to concede such privileges than to withdraw them afterwards without causing dissatisfaction. One kind of rest period was practiced long before the modern attention to the matter. It has been the source of amusement to American visitors to British offices to find that afternoon tea was a settled institution in many of them. As a matter of practice, however, this was found to refresh the workers to the advantage of the firm. The reason has been made clear by the studies in fatigue that have since been made. In many plants it is now the custom to give short periods of rest and relaxation as the work allows. In very heavy work, or work under bad conditions, as in hot rooms or at the mouth of a metallurgical furnace, it is sometimes necessary to allow rest periods amounting to a high percentage of the total time.

Though the movement of fatigue study is as yet in its infancy, there is no doubt that it will repay the executive to keep in touch with its development.

**18. Revision of Layouts.**—In surveying an active business, opportunities for the promotion of quality and quantity other than the application of analytical study will frequently be found. For example, it is well at reasonable intervals to make an examination, or inventory, of the layout of organization. In any large organization it often happens that, after some time, the allotment of duties will have become obscured or blurred. Some duties will have become obsolete, and new ones will have come into operation. The assignment of new duties will in all probability have been made in accord with the convenience of the moment, so that the layout tends to become more or less confused. It is therefore desirable to make, occasionally, what may be termed an inventory of duties actually performed by each member of the organization. A report is obtained from each person enumerating the various blanks handled, the operations performed on them, the average time taken up by each, and also all duties not directly con-

cerned with work on blanks and papers. By studying these returns in the light of the layout scheme (which should exist in chart form) a modification of allotment can be made so as to restore the proper relations between the several members of the organization and the work to be performed by each.

**19. Balancing Equipment.**—In some businesses not only will the layout tend to alter its balance, but the operative equipment itself will do so. In all establishments that are not standing still, the parts of the organization will be growing very much as a tree grows, in irregular fashion. There will be shoots here and shoots there, a limb thrown out in this direction, and a twig in another. This is inevitable. All that can be done is to keep in close touch with the process of growth. As regards the operative equipment, intimate touch with the situation is secured by charting the actual performance of each machine, that is, the time during which the machine is actually producing and the time during which it stands idle. Such a chart will be discussed and illustrated in a later article. Changes in the course of work can thus be followed, as they affect the use of particular types of machine. Changes in process may cause certain types to become more or less idle, while crowding others with work. Very few executives have any real idea of how their machines are actually contributing to earnings. This matter is left, too often, to guesswork, usually over-optimistic. It has been pointed out several times that, in manufacturing businesses, it is only the machine at work that makes money. There is no other source of revenue. This cannot be too often repeated or taken too much to heart by the executive. The method herein indicated will make it possible to be forehanded when changes are in progress, so that they can be provided for by installing new and removing obsolete equipment.

**20. Standardization of Product.**—Great opportunities for economy are often discovered by an examination of the product with a view to standardization. This is a somewhat vague term, having more than one meaning even as commonly used in industrial matters. Suppose that a certain product

is manufactured, with a range of sizes. One kind of standardization consists in so designing the different sizes that certain parts are common to more than one size. This does not mean that any one part is common to all the sizes, but that a certain part may be common to, say, the three smallest, a second one to the next three, and a third to the next three, and so forth. The idea is to have as few parts as possible concerned in the assembly of all the sizes together. This standardization is often a long and highly technical undertaking, which must not be hurried, because every care must be taken to see that no efficiency in the product itself is sacrificed to the exigencies of economy in manufacture. Many savings are secured if the plan of standardization is well designed. Parts can be made in larger lots, storekeeping and bookkeeping are simplified, and greater care can be given to absolute uniformity of quality in each part. Where stocks of replacement parts have to be kept by dealers, the chances that a full stock will always be in hand are increased.

**21. Standardization by Retrenchment.**—A special type of standardization, which came into particular prominence during the World War, is that by retrenchment. A survey of the different sizes and varieties of product may disclose that certain of them are in comparatively little demand, while others bring but little profit. In an emergency, such as that caused by the war, it may be found advantageous or even inevitable to retrench, to abandon the making of odd sizes, little used or bringing small profit, and to put the whole energy of the plant upon the production of indispensable articles and those which, being in urgent demand, bring a high profit.

While there is justification for this method of standardization by retrenchment as an emergency measure, it cannot be said to be a good general policy. The tendency of all progress is toward differentiation, that is, toward more variety, rather than toward less variety. Civilization largely consists in increasing refinements, that is, in the popular consumption of more and of different kinds of things. As a practical point, over-standardization, if kept up too long, is apt to raise a

crop of competitors, who will presently cater to the tastes thus left unsatisfied, and who may so creep into possession of a field deliberately left open. The evil of specialization is its inelasticity. You cannot compel the customer to buy the standardized article, and he will cease to do so when one nearer to his wants is forthcoming. Therefore, this kind of standardization should be applied with caution, and always with the intention of resuming the broader field as soon as trade conditions permit.

**22. Working Period.**—Some industrial operations are practically continuous, hour after hour and day after day. The operation of a furnace is of this class; if the furnace is allowed to cool, a heavy loss is incurred in starting up again. In other cases of continuous industry the workers' wages form a relatively unimportant part of the total expense, and the three-shift system is easily made operative. In the case of the ordinary manufacturing plant the question is by no means so simple. If the plant is to lie idle sixteen hours out of twenty-four, this means a greatly increased share of overhead expense per hour actually worked. Doubling the working force so as to provide two shifts is not as easy or as complete a solution of the problem as it appears. The objection is two-fold: first, two sets of men are occupying the same field in the lay-out of organization, making it difficult to allot responsibility in case of untoward happenings; second, it is often awkward to transfer work in actual progress from one operator to another at the change of shift. The work is likely to suffer, and there is again a fertile field for dispute as to who made the error if anything goes wrong. The double and treble shift must, however, ultimately become prevalent, unless industry is to receive a permanent set-back which will counteract and indeed go far to nullify any advantage the workers obtain from shorter hours.

**23. Overtime.**—The same objections do not apply to working overtime as to double-shift working. In working overtime there is no division of responsibility and no break of job between two workers. Overtime, however, is not only expensive, being usually paid for at a special rate, but it is



also contrary to the modern principle that shorter hours are conducive to better work. A proper field for overtime is in seasonal work. Where the nature of the work is such that additional help cannot be obtained at the busy period, overtime is the only resource available to meet the situation. In industries thus affected the workers are usually willing enough to work as long as allowable, recognizing that it is their time of harvest. In some cases the firm itself is against the policy of allowing overtime, or rather is in favor of reducing it to a minimum. The argument is that it is not remunerative, not only on account of the increased rates of wages, but because of an atmosphere of greater laxity and inattention. Much, however, depends on the general relations existing between the firm and its employees. Where these are cordial, a moderate amount of overtime can frequently be put in without the work suffering in any respect; but if the workers are unwilling, the best results will certainly not be forthcoming.

#### CORRELATING RESULTS AND REWARD

**24. Methods of Remuneration.**—The idea of proportioning remuneration to output is as old as industry itself. Two main ways of doing this have been in use from time immemorial. One is known as payment by piecework, in which a set price is made for each unit of work performed. The second, much less common, and only applicable to certain kinds of work, is known as the *stint*. In this latter system, so much work is assigned to be done in a given period, usually a day, and when the job is finished the worker is free for the rest of the day. It will be noticed that a different kind of reward is provided in each case. In the first, extra effort is rewarded by more money, and in the second, by more free time. Although there have been some proposals to revive and apply the stint system to modern conditions, it has not, at present, sufficient practical importance to merit further discussion here.

**25. Piecework.**—The method of remuneration by setting a fixed price per unit of finished work is in common use. From

it have been derived nearly all the more recent special methods of remuneration, by premium, bonus, etc., although some of these have now so far developed that the connection is visible only to the expert who is versed in the fundamental principles of wage payment. At first sight nothing seems simpler or more just and equitable than payment on a piecework basis. The conditions are very simple and obvious; there can be no misunderstanding about terms; the worker is free to do as much or as little as he may feel fit for at the moment. Such a method would seem to give greater freedom and independence to the worker than any direct system of paying wages by the day. Nevertheless, organized labor, that is to say, labor that is in a position to express its likes and dislikes, does not look with any great approval on piecework. As this attitude is fundamental, and extends to other systems of payment by results, it may be worth while to consider it in some detail.

**26. Objections to Piecework.**—To speak colloquially, one of the great objections raised by labor to remuneration by a fixed or set price per piece is that such prices will not "stay put." In other words, while day wages as a whole, excluding temporary depressions, tend to rise, the universal tendency of piecework prices is to get lower and lower as the workers become more skilful. In England, where modern industry took its rise and where some localized industries have been continually worked for a century and a half, or more, may be observed some striking instances of this tendency. Not so long ago there existed whole industries, such as the hand nail and chain trades, in which piece prices had been customary beyond the memory of any person living, and in which the whole working population, though exercising great hereditary skill, was reduced to the barest necessities of existence by reason of the piecework system under which they worked. Instances nearer at hand can be cited also. Nearly all sweated trades are based on piecework. Where there is great competition among workers it would seem that they will accept reduced piece prices more readily than reduced day wages. This is probably because the limitations of a low wage rate are clearly perceived

and cannot be misunderstood, while in regard to a lower piece price, the worker hopes by extra exertion to make up for the cut in rate.

**27. Piecework in Factories.**—In the case of the modern factory the tendency to reduce piece rates is not so marked; still, there is in general a disposition to do so as soon as the workers' earnings rise above a certain percentage of his normal day rate. The average employer of the old school could not endure that a worker should make, say, double his normal wages, even though his doing so was not in any degree at the expense of his employer. Hence, as soon as earnings became swollen, some excuse was sought to cut the rate. This procedure, of course, did not escape the attention of labor, and it was promptly countered by a settled policy on the part of the worker not to increase his speed beyond the point at which a moderate increase of wage resulted. After that limit was reached, he took life easily. In effect, this came near to making a stint system out of a piece-price system. The limit would vary in different shops, as it was based strictly on the experience in each shop as to how much extra pay the boss would admit without cutting rates. After a time this situation became thoroughly understood on both sides, with the result that economists sought for some new method of remuneration that would obviate the tendency to cut rates on the one hand or to slow up work on the other.

**28. Sliding Scale Systems.**—The first attempt to reconcile the divergent attitudes of labor and management on the question of remuneration was in the direction of an unequal division, on a sliding scale, of the savings so effected. It was argued that the reason why employers cut rates is because all the savings go to the worker, whereas the employer is entitled to a portion of them. Therefore, instead of a fixed price, a new system was worked out in which a premium was offered to the worker if he could reduce the time occupied on a job below a certain standard time. The savings so effected were divided between employer and worker either in some fixed proportion or on a sliding scale, so that at different stages of efficiency the

saving was divided between the two parties in varying proportions. It was supposed that some vital and novel principle had been discovered that would settle once for all the dispute between labor and management as to remuneration. Actually, however, there is nothing in any of the methods that differs in more than a slight degree from straight piecework. Piecework gives the worker 100 per cent. of the savings and premium systems give him anywhere from one-third to one-half of the savings in various complicated ways, and that is about all the difference.

**29. Finding a Price Basis.**—The next step toward the establishment of an equilibrium between the demands of labor and those of management was in the direction of establishing the piece price, or the standard premium time, on a scientific basis. Hitherto such prices had been settled by the individual judgment of some supposedly qualified person. This method produced very great discrepancies, since judgment is not to be relied on where the elements of a problem are so numerous as in price fixing. Consequently there was next introduced a detailed study of the elements of the job, known as time study. This was the original purpose of time study, although now its sphere has been much widened. It was argued that if the true and reasonable time for doing a job was scientifically established, no further dispute could arise over the question of remuneration. Labor, however, does not seem any more satisfied with piece or premium prices so established than before. In truth, the whole question remains much where it was. Of course, time study is an enormous improvement over the haphazard methods of fixing rates formerly in vogue, but cutting of rates is not rendered any less likely, except that perhaps the opportunity for making unusually large wages is less frequent, inasmuch as these were based on errors in price fixing.

**30. Question of Quality.**—In all the methods for urging production that have been discussed it might be thought that the question of quality has been subordinated to that of quantity. Actually, however, this is not the case. All piece-

work or premium systems rest on the supposition of work perfectly performed. That is to say, the price is paid only for such articles or pieces of product as will pass inspection. This works in two directions: first, payment is made only for good work; second, the worker's attention is very forcibly directed toward producing work that will pass the standard of inspection. He has therefore a direct and very vital interest in producing perfect work. No such direct stimulus is felt by the worker on day wages. The strong desire of all employers to work under some form of piece or premium is therefore to be explained on other grounds than that of mere saving in production. The extra earnings of the worker are a reward for production not merely of more work but of better work. Such a condition stimulates his interest and gives him to some extent a craftsman's pleasure in the quality of his product. While it cannot be said that the problem of remuneration has been even nearly solved, it seems certain that the ultimate solution will lie much nearer piece work than daywork. Evolution of methods in this direction has by no means completed its course.

**31. Indirect Method of Reward.**—All the methods discussed so far had to do with the reward of individual workers. They are in the nature of so many direct contracts with individuals for the production of definite articles. There remains to be considered another variety of reward, directed not to the individual but to an associated group of workers. This is altogether another field and deals with a different kind of stimulus. While this kind of regulation of pay depends on very accurate cost keeping, it does not in any way rest on time study, although such study may be brought into play as an assistance to the workers, if agreeable to all concerned. Briefly, the method is this. Suppose a certain shop, say a cloth dyeing department, has an output of 100,000 yards a week, at an average cost for labor and supplies of 1 cent a yard. This is considered standard. Now, the firm may point out that this standard cost is capable of being reduced by greater promptitude in handling work, by avoidance of waste of dyes and supplies, and by care in manipulation, with consequent reduc-

tion of spoilage, etc. The firm may then offer to set aside a percentage of the savings made by the shop and distribute the amount on a percentage-of-wages basis among all the workers in that shop.

**32. Group Bonus System.**—The plan of distributing among the workers a share of any savings effected by their direct efforts is called the group bonus system. The psychology of this method is entirely different from that of premium or piecework. To a limited extent it makes all the workers in the shop partners in the business. The elements to be considered in setting up a datum line to start from are very simple. All that is necessary is to have accurate accounts of what actually goes into the shop, in the way of material, supplies, and wages, and what comes out in the way of perfect product. If after, say, a month's trial of the system, it is found that more yards have come out at the same cost, or the same number of yards at less cost, it is obvious that there is here a fund from which increased reward can be paid to the workers concerned. Part of the fund may be set aside to improve the facilities of the shop in various ways. This is an investment in the interest of the workers as well as of the firm. Next, a certain percentage may be retained by the firm as its share of the saving. The remainder is available for distribution among the workers on any fair basis, the more usual being a distribution *pro rata* on their ordinary day rates. The important point of this method is that more than actual process work is brought under its sphere of action. The worker's field of interest is extended in all directions that have any bearing on the volume of production.

**33. Practical Effect of Group Bonus.**—In certain processes it is not possible for the operator to speed up the work. The example already cited, namely, a dye shop, is a case in point. Each kind of fabric has a certain speed of processing that is wholly independent of the machine operator, though it is affected somewhat by the accuracy with which the dye formula has been written, a matter quite outside the worker's control. Savings cannot be expected, therefore, from the ordinary source of piecework earnings, namely, speeding

up. There are, however, a number of ways in which the worker can influence the result. First, attention to various points will secure a more uniform product. There will be less cloth wasted on account of defective processing. This is well within the worker's range and is a very telling economy. Next, economies, often very considerable, can be effected by avoiding waste of the costly dyes and chemicals used; third, by prompt handling of finished rolls and replacing them by new work, the machines can be kept more continuously at work. Care in cleaning vats, and in handling the finished product will also contribute to the fund of savings. All these items added together make a considerable total. Moreover, the interest of each worker is the same. Instead of being jealous of each other's earnings, they will realize that every one must do his share of saving, and therefore they will keep watch for individual carelessness in a way impossible to any official paid for such supervision. To the extent of their benefit in the savings the workers are virtually partners with each other and with the firm. If they can be induced to realize this, an excellent atmosphere will result.

**34. Limitations of Group Bonus.**—The group bonus system cannot very well be applied indiscriminately to all kinds of industry. It is chiefly applicable to cases similar to that cited, where the product is of a simple and uniform character. In such a case the accounting necessary is not complex; in fact, little, if any, additional accounting is necessary. It is, however, absolutely essential that the bookkeeping shall be accurate, and admitted to be so by the workers who are under the system. The entire effect of the method is dependent on absolute confidence in the fairness of the methods of assessing savings. Therefore it is well to arrange for a committee of the workers, if sufficiently qualified men can be found among them, to act as a sort of board of audit, as far as the shop figures are concerned. Where the product of a shop is very varied in character, as, for example, in some machine shops, the chances of introducing the method with effect are not so good. The group bonus is particularly adapted to those cases in which

the workers are unable to control the speed of operation but may do much by subsidiary activities to effect savings that would be difficult to secure in any other way. The method does not preclude the application of piecework at the same time; but it is chiefly applicable in work that does not lend itself to a basis of individual contracts with the workers.

**35. Non-Productive Departments.**—The work of clerks and other minor officials can sometimes be placed on a piecework basis with advantage, provided the work is wholly or chiefly of a routine character. Thus, typewriting can be paid for per line or per letter; the punching of tabulator cards is frequently put on a piecework basis; the checking of posting of routine blanks may sometimes be paid for in the same way. In all such cases, the price is fixed for perfect work. This implies that deductions are made for each error, and perhaps more for one kind of error than for another. It will be evident that the trouble of recording and checking clerical work is not worth while unless it is being performed on a large scale, with many persons doing the same or closely similar work. In very large offices, where the clerks number scores or even hundreds, some arrangement of the kind is quite feasible and will assist considerably in the promotion of quality and quantity in the work. Office people differ among themselves in manual skill and in mental dexterity, just as much as do operative workers. Consequently, a flat wage rate based only on length of service is not very satisfactory, nor likely to bring forward the kind of talent that may be particularly suitable for certain kinds of work. One of the good points of applying piece payment to office work is that it does help to set up standards of performance and assist in putting the square pegs in the square holes.

**36. Indirect Method of Allotting Benefits.**—Unless work in a non-productive department is of such simple routine character that it can be reduced to clearly marked units on which piece prices can be based, the method just described is inapplicable. But there is another way in which a stimulus may be given, not as satisfactory as the piece-rate method, but



far better than none. This is done by making a portion of the remuneration depend on some salient feature of current business. For example, the benefit may be based on tonnage, on value of output in a given period, on number of articles sold, where these are fairly uniform in character, on yardage in a textile concern, or on the number of orders, where the latter are very numerous and each involves about the same amount of work to the department. A reward so apportioned is in the nature of a bonus, or extra payment, over and above ordinary salary or wages. The underlying principle is that such a bonus makes it a matter of self-interest to the department to push the work along, so that the greatest possible output may be turned out in a pay period. In some cases a bonus is paid to repair and maintenance departments on this basis. The repair men thus acquire an interest in keeping things going, and seeing to it that no obstacle to production arises. In every case the basis on which indirect bonus is fixed should have as close a relation as possible to the department work. Thus, a repair-department bonus may depend on output, while an office bonus in the same plant may depend on number of orders.

**37. Profit Sharing.**—Many attempts have been made to enlist the cooperation of workers by admitting them to a share of the net profits made by the firm in a given period. Very few of these schemes have been successful for any length of time. Not infrequently, such a scheme will produce, or appear to produce, good results for a considerable period, and yet will not survive any hard shock. It would seem that the method should obviate wage disputes. To a limited extent and with some kinds of labor it appears to do so, but the cases are so few and indecisive that it is questionable whether the freedom from labor trouble is due to the profit sharing after all. Many firms will proceed for years without actual trouble, without any system of profit sharing or any attempt to increase wages beyond the bare current standard. The real influence for good by the plan of profit sharing is therefore as yet undetermined. It is admitted, however, that it has serious disadvantages. The reward is not only small, but very remote from the

time at which effort is made. Often, too, from no fault of the workers, there may be no profit to be divided. Yet in just such a period all hands may have been putting forth their best efforts. It is probable that the time is hardly ripe for profit sharing as a panacea for trouble. The same amount of money set aside and expended in one of the more direct ways of reward previously discussed would probably give superior results, because of the closer connection between the extra effort and the extra reward.

#### INSTRUCTION AND EXPERIMENT

**38. Introductory.**—Two powerful aids to the promotion of quality and quantity have been, strangely enough, almost neglected in industry until very recent years. One of these is instruction, the other experiment. By instruction is here meant instruction of the worker and of the officials in the best ways of doing their work; and by experiment is meant, not technical experiment, but investigation on the part of the firm to find out the best ways. Both these ideas seem very obvious, yet even today it is only very advanced, and for the most part very large, firms that make any systematic attempt to apply either. The old method of starting a new employe was to install him without further preliminaries in the shop or office, and then to let him pick up his job as best he could. As for the old method of experiment and investigation, there was none. The actual way in which things happened to be done was assumed to be the best way. To suggest that such a matter was properly a subject for inquiry would have been looked on as absurd. Not a few firms are still in this self-satisfied attitude, but the most progressive have abandoned it, and found that it has paid them to do so.

**39. High Cost of Making Changes.**—There is a close connection between the work of experiment and instruction. It is necessary not only to discover the best way to do things, but also to communicate this information to the workers of all grades. In particular, the duty of the department taking care of these matters is to take the newcomer and put him through

a course of instruction in the work, whether in shop or office, that he is engaged to do, and then pass him on to his sphere of duty already familiar with its needs. It has been estimated by a high authority, after a long and careful investigation and consultation with employment managers all over the country, that the average cost of hiring and firing an employe is not less than \$35. This includes merely actual money loss to the firm, without reckoning anything for the annoyance and confusion caused by the injection of green hands into a busy office or shop. But this is not all. The very fact that a new employe has to be tried out on actual work before his fitness is determined, means that a very large and unnecessary number of people are hired only to be found unfit. It is evident, therefore, that it is worth something to remedy this condition, and to set up a mechanism for trying out raw material, and, if it is found suitable, training it to the point where it can take its place in the routine without disturbance.

**40. Training Department.**—Where the nature of the equipment permits, it is becoming a custom to set apart a series of machines in a separate department under the charge of men who are not only experts in the use of each type, but who have also been found to possess the gift of teaching, a matter that is wholly apart from the possession of manual skill. In other cases, where machinery is too costly or too bulky to be set apart in this way, the plan is followed of allotting certain machines within certain hours or on certain days to the instruction department. Learners are then taken into the shop and taught to operate the machines there. It seems to be conceded that the separate department offers the best results. When the new employe has graduated, he can take his place in the shop, but he is not allowed to do so until he has passed a certain standard. Consequently, it will happen here and there that an employe fails to pass the standard after the most careful coaching. In such cases he is given an opportunity to try his hand at some other work, not haphazard, but selected after consideration of the qualities and defects he has shown in the course of training. Failing in this, he is rejected. But

every effort is first made to ascertain whether he is not really fitted for some job that the firm has to offer, on the principle that a man already in the school is worth two who have not yet made acquaintance with the firm at all.

**41. Further Instruction.**—In some concerns an endeavor is made to carry the instruction of the new worker a stage further than bare exercise in his routine duties. It is argued that he will be an asset of superior value to the firm if he is given some idea of the relation of his special work to the remainder of the organization. In other words, if it is true that he is only a small cog in the machine, it is assumed that he will be the better for being shown just what kind of cog he is, and how he gears into other cogs and helps to turn the big wheels of the undertaking. Before going into the shop, the graduate is therefore taken through the plant and explanations are made. Sometimes moving pictures are taken of all the principal departments and lectures based on these pictures are delivered to the newcomers, so that they become interested in the surroundings in which they are perhaps to spend a considerable part of their lives. Where product, for example, goes abroad into unfamiliar scenes, pictures of such scenes may be obtained from agents on the spot. A train of mules carrying machines that have been built in the plant, pictured in some wild mountain defile or perhaps amid tropical scenery, cannot fail to strike the imagination and arouse the enthusiasm of all who have worked on that particular machinery. Such forms of instruction and influence cost little, and may do much to establish an atmosphere of solidarity between management and workers. Most persons will readily respond to treatment and instruction of this kind. Their imagination is touched and their good-will enlisted.

**42. Instruction Manuals.**—Another direction in which experiment and instruction coincide for the benefit of the worker is in the preparation and issue of instruction sheets and manuals embodying more or less detailed instruction as to the proper method of doing work of various kinds. The need for this type of instruction will vary to a great extent, depending

on the nature of the business. In machine shops and engineering works, for instance, specification of the way to do particular jobs is a highly technical matter and is therefore part of design. In other cases standard practice can be worked out by the training department in conjunction with the plant officials, and instructions can be printed in such form as to serve for sufficiently detailed guides to the performance of duties of all kinds. A good deal of valuable information can be accumulated, and if intelligently compiled, manuals so prepared may prove of great assistance to the man who is in charge of a job and who is eager to acquire all the information about it that he can. Many of the points covered in the instruction room can be condensed in the manual. The worker is thus able to go over the ground as often as he desires and to refresh his memory as to situations that do not often recur. Almost any employee will read a book of this kind with unremitting attention, just as a trained engineer or specialist will read a technical book on his own subject. The trouble with so many jobs is that the imagination of the worker has nothing to feed on. Instruction manuals, if well designed and arranged, can in many cases serve to remedy this deficiency.

**43. Americanization.**—The outbreak of the great war brought home to the American people the presence of a great mass of unassimilated foreign population, that so far from becoming fused in the melting pot was, on the contrary, maintaining itself much on the low level from which it had come, without adopting American standards of living or ways of thought. Since then, a considerable number of employers have taken the matter in hand as far as the foreigners in their own employ are concerned, and have endeavored, not without success, to promote a knowledge of English among them, and otherwise to educate them up to American standards. In many plants today classes in English and citizenship are regularly held, and foreign employees are encouraged to take advantage of them. There can be no doubt of the value of this work. To say the least, the presence in a plant of a number of men who are unable to understand instructions, or to read warnings in

English, constitutes an element of danger. But more than this, the foreigner who persistently remains foreign is likely enough to become the prey of agitators, and to be influenced by them to evil ends, precisely because he is living in an environment of which he knows nothing, and of which he is therefore ready to believe the worst.

**44. Control of Promotion Efforts.**—When any of the methods described for the promotion of quality and quantity are set in motion, it becomes very important that records should be made of the resulting improvement, if any. As most of the matters to be dealt with are full of detail, involving time and motion study of a minute nature, it is not possible for the executive to become personally identified with the work or to give it personal supervision. Nor is it necessary for him to do so. His interest lies in the general trend of the operations, not in the approaches to or departures from success met in particular instances. In the case of time studies, the reduction made in operating time should be placed before him in chart form at least once a month. The increased precision or range of quality should be charted by exhibiting rejections at inspection points. The question of equipment balance should be studied by means of idle-time reports. The situation as to overtime and night work can also be charted. Finally, when piecework, premium, or bonus systems are in use, the executive should have before him charts that will exhibit the relation of such extra earnings to day wages, department by department. In the following articles some examples of such charts will be given and their working and use briefly described.

**45. Time and Motion Study Results.**—A useful type of chart for recording the reduction in operative time brought about by time study, etc., is shown in Fig. 3. As drawn, the chart is on a percentage basis; that is to say, the original time occupied on the work before the time study was undertaken is made the datum line and is regarded as 100 per cent. The per cent. of time saved is then plotted from above, the shaded portion showing time saved and the blank portion of each column consequently representing the new working time.

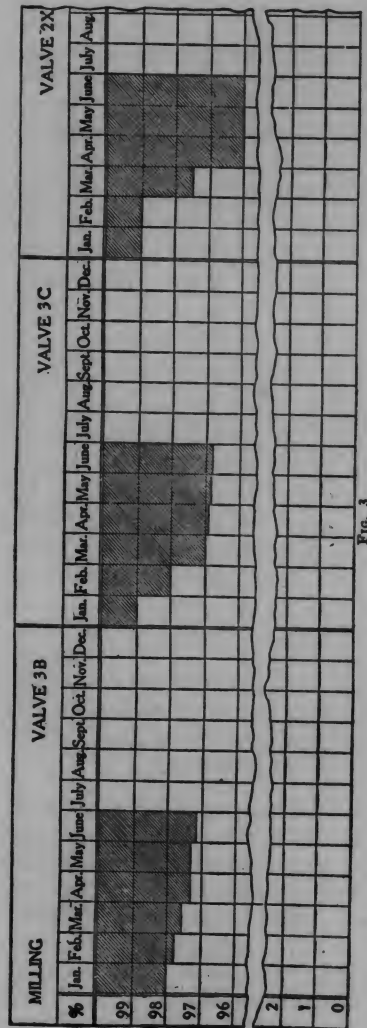


FIG. 3

Charts of this character may be put before the executive in much or little detail, as he deems best. In the case shown, all the milling-machine work on a particular type is consolidated. Though shown as one item, it may represent five or more actual and separate milling operations on different parts of the valve, all of which have been time-studied separately. The chart shows three separate types or sizes of valve, it being assumed that other sizes, which have not yet been subjected to time study, are added to the sheet as and when time studies have been made. Other machine operations may also have been studied, such as drilling, slotting, turning, etc. Separate charts can be made for each such process, or all the machining processes can be consolidated, and a general machining chart, for each valve, put before the executive. It is evident that the principle can be applied in several ways to meet particular conditions. The chart is

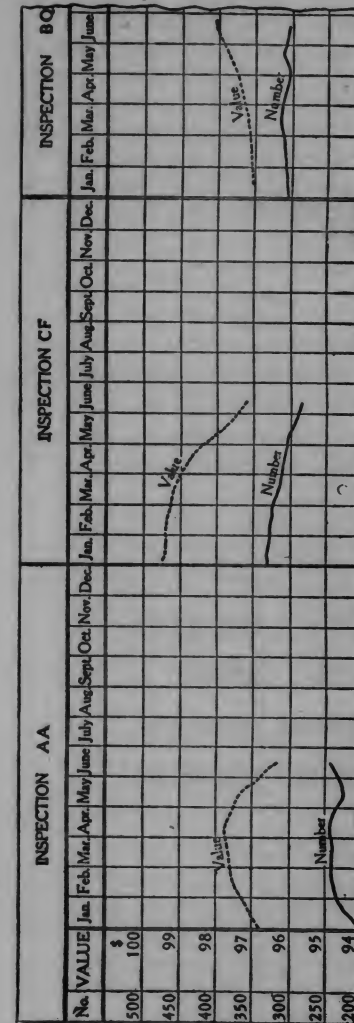


FIG. 4

read by inspecting the gradual increase of the shaded portion in each chart. The lower this creeps, month by month, the more successful the result of the time and motion study.

**46. Increase of Precision and Quality.**—The measurement of quality can be best made by recording the results of the regular inspections made at various stages of product. At each of these there will be, day by day, so many rejections for cause. In some cases the work is graded rather than rejected; that is to say, it is classed as firsts, seconds, etc.; but in most instances, as in machine work, product either passes or does not pass inspection. Usually, in such work, the rejected piece is scrapped. The value of the material falls to that of junk, and all labor expended on the piece is lost. Hence, it follows that the value of lost labor and material does not necessarily run



in proportion to the number of pieces rejected. Some may carry more labor than others. In the chart, Fig. 4, provision is made for recording both the number of pieces rejected during the month at each inspecting point, and also the value of the material and labor so lost. The returns are made up monthly, and a glance at a chart prepared in this way will show the executive the general trend of the situation. In the charts given as examples it will readily be observed that at inspection points *AA* and *CF* the value of rejections is falling rapidly, though there is a tendency to increase in number in *AA*. In inspection *BQ*, on the contrary, while the number varies within narrow limits, the tendency is for the loss to increase in value. Thus the direction in which the executive should turn for further information is seen immediately, while the other inspection points can be ignored by him.

47. **Balancing of Equipment.**—Reference has been made to the necessity of keeping close watch on the extent to

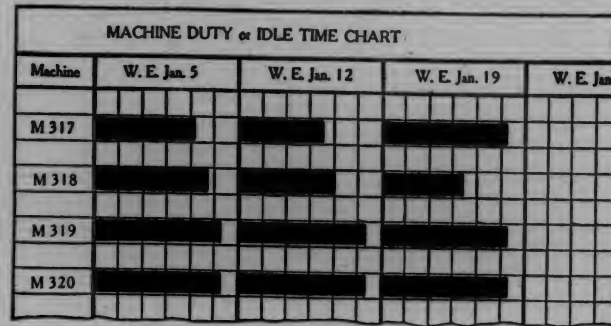


FIG. 5

which operative machines are actually occupied or stand idle. A convenient form of chart for presenting these facts to the executive is shown in Fig. 5, in which one division represents one nine-hour day, and the black fields represent time in actual operation. As drawn, the chart relates to individual machines. This is not necessary if the machines in a department are all

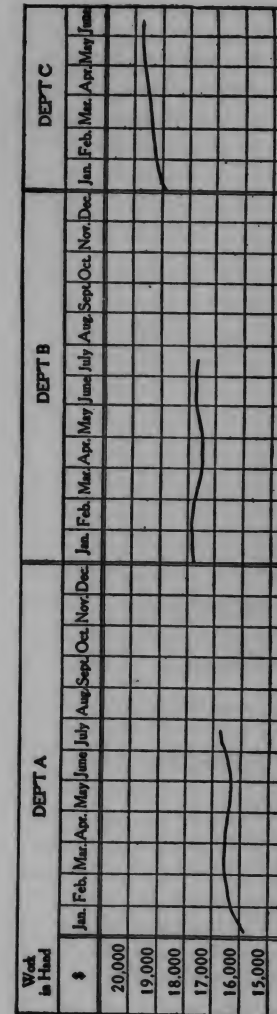


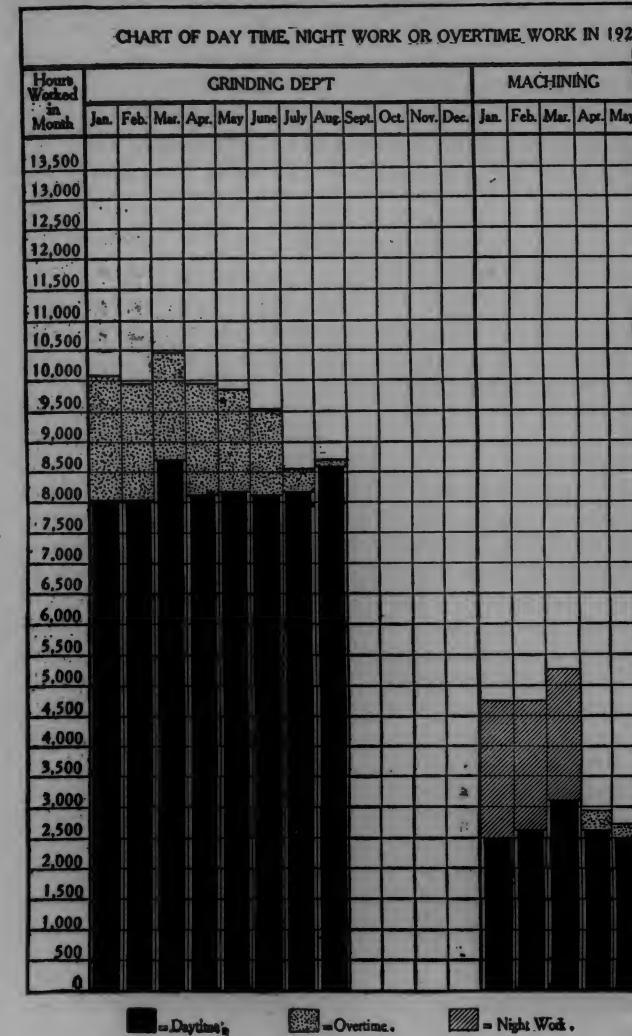
FIG. 6

alike. In such case a single line will suffice to represent the time of operation of all the machines taken together, the only difference being that the divisions of the chart, instead of representing a nine-hour day, must be arranged to represent a multiple of that time. If it is assumed that all productive departments of the plant consist of exactly similar machines, then the indications *M 317*, *M 318*, etc., may be regarded as representing so many departments instead of single machines. It should be clearly understood, however, that this latter disposition can be made only if and when a department is made up of machines all absolutely alike. If different machines were mingled in one chart-line, then the data would lose all significance. In the chart presented, it is readily seen that machines 317 and 318 are not being worked at anywhere near full capacity. Such a condition is a case for inquiry as soon as it appears that it is habitual. The control that a chart like this gives over the balance of equipment will easily be understood without further explanation.

48. **Balance of Work in Hand.**—Particularly when

changes of system are in progress it is important that a watch should be kept on the way in which the work is passing through the departments. In fact, control of this kind should be exercised under any circumstances, because any considerable variation in this item shows some abnormal condition in the shop affected, which should immediately be made the subject of inquiry. Fig. 6 shows a chart in which the balance of work in hand at the end of each month is plotted separately for each department. Under ordinary conditions the curve should be nearly a straight line, or at any rate should vary only within narrow limits. In some cases, however, it will exhibit a cycle of changes, as in seasonal work. At the beginning of the season it will rise sharply, continue fairly level, and then decline sharply at the close of the season. It is therefore necessary to read a chart of this kind with due attention to the general status of the business. In the illustration, it will be noticed that no department exhibits any steady inclination either to rise or to fall except within narrow limits. The curve in department C, however, shows a tendency to rise, and if the curve were to continue in the same direction during the next months, the executive would make inquiry into the matter. Where changes are in progress, such curves can be plotted weekly, thus guarding against any undue congestion in a shop from any cause, since high congestion would be discovered before it had gained serious headway.

**49. Night Work and Overtime.**—All work that is paid for at extra rates should be subject to special attention on the part of the executive, particularly if it is in no way related to seasonal causes. The amount of overtime worked in each department should be charted monthly and put before the executive. The same remarks apply to night work, where this is occasionally resorted to. The chart, Fig. 7, shows how the data may be plotted. The heavy black columns represent the total hours of ordinary day work, which may be either straight wages, piecework, or premium. Above this is plotted the total number of hours worked during the month on overtime or night work. The proportion between the two may be



seen at a glance, also whether the extra-pay time is being increased unduly or not. In practice, different colors would be used to distinguish overtime from night work. A glance at this chart by the executive at the end of each month will suffice to show him exactly what is going on in each of his departments. The chart may be read in connection with that of Fig. 6, which shows the balance of work in hand in each shop. Thus a decreasing balance in hand, below normal, if accompanied with a record of considerable overtime will suggest at once that the latter has been undertaken unnecessarily. At any rate, it points to the need of further inquiry.

**50. Results of Group Bonus.**—When a group bonus system has been introduced, the results should be charted weekly, as exhibited in Fig. 8. First, the output of the shop is valued at the old or standard shop cost. This forms the upper limit of each column. Next, the amount of wages paid is plotted by a black column beginning at the bottom of the chart. Above the wages the other shop expenses are plotted, as indicated by diagonal shading in the diagram. The upper limit of this field represents the actual shop cost of the output, or wages plus expenses. The space between this actual shop cost and the extreme mark corresponding to the old cost represents the savings made under the new regime. It will be remembered that these savings are distributed in three directions. First, a small sum is allotted to a shop-method improvement fund; next, one-third is retained by the firm; and the remainder is distributed to the men pro rata, according to their wages. The upper black column represents this bonus. Above this is the small shop-methods fund, and above that is plotted the amount retained by the firm. In the example shown it will appear that a steady improvement has been made. Shop cost has been reduced while output has somewhat increased. Consequently the bonus has grown, and of course the firm's share in proportion. On March 12 a total saving over old or standard cost of about 19 per cent. has been made. Labor's share of this is \$120, which is distributable over a wage total of \$700. The percentage as distributed



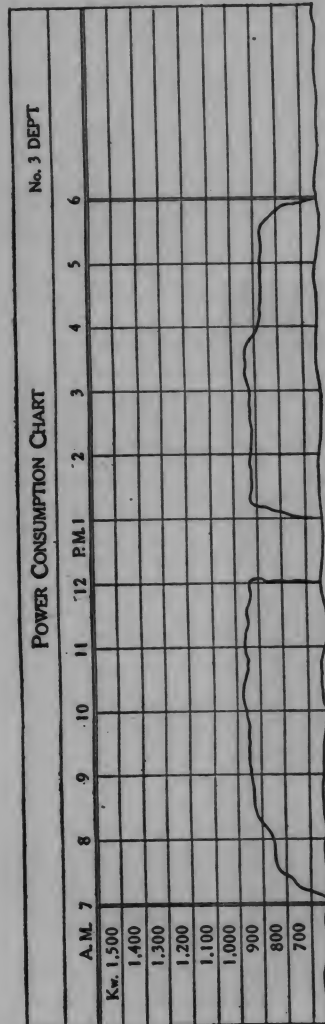


FIG. 9

amounts to about 17 per cent. on wages. This would be a satisfactory showing in favor of the new system. The firm's share is \$70, plus about \$20 placed in the shop-methods fund for use in improving the shop service as may be found possible from time to time.

**51. Watching Power Consumption.**—Some interesting information can frequently be obtained by watching the curve of power consumption in the shops. It will be understood that power is consumed in proportion to the degree to which machines are actually doing work. This applies especially to machine shops, but is true of many other machine industries also. In a shop where control is lax it may happen, especially near the hours of commencing and leaving off, that machines are idle to a much greater extent than is justified. If the power consumption is recorded by means of a proper recording apparatus the results are worth glancing at by the executive at frequent intervals. In some

cases he will probably be able to read the actual record from the apparatus; but if preferred, he may have it transcribed into more intelligible shape, as shown in Fig. 9. A glance at this chart shows that between 7 a. m. and 8 a. m. a good deal less than the full amount of power is consumed. Power shuts off quite promptly at noon, but the resumption at 1 p. m., though much sharper than at 7 a. m., still leaves something to be desired. Again at 5.30 p. m. it is evident that many machines begin to slack off so that much time is being lost at this end of the day also. This is a bad case, but not an unusual one where control is not of the best. Such conditions are almost undiscoverable save by using a chart of this character.

#### EXERCISES

- (1) Point out some of the advantages and the weak points of the piece-work system.
- (2) Explain the method of standardization by retrenchment, and show where its weakness lies.
- (3) Show how improvement in quality tends to work automatically toward increased quantity of output at the same time.
- (4) How can a bonus system be applied to a non-productive department, in which there is no output of finished goods to serve as a basis for the allotment of benefits?
- (5) What is the present position and experience with regard to the general merits of profit sharing as a means to satisfy labor?
- (6) What are some of the most important advantages and disadvantages of working by double or triple shifts?
- (7) Explain how a sliding-scale system can be made to compensate in part for some of the disadvantages inherent in piece-work payment.
- (8) Discuss the attitude taken by employers toward overtime work. The answer to this question should cover also any special conditions that call for exceptional consideration.
- (9) Illustrate by the example of Fig. 9 how and why the executive should keep a watch on the power consumption.
- (10) Explain how economies can often be effected by the method of standardization of product.



## CHAPTER IX

### THE EXECUTIVE AND FINANCE

#### PROPERTY AND ITS VARIOUS PHASES

**1. Introductory.**—It has been pointed out in an earlier Section how in the course of development or growth of a business from small beginnings the executive sheds one function after another, and devolves duties on subordinates, until, when the process has reached its full development, nothing but the purely determinative function is left to the executive. By determinative function is meant that of making final decisions affecting the policy to be pursued and the steps to be taken by the subordinate officials in charge of the other functions. In brief, the function of the executive is to make decisions.—And as the principal aim of business is to make money, that is, to increase the value of the property owned by the firm, it follows that a very close acquaintance with the values of property in all its various phases and kinds is essential to the executive if he is to be in a position to make wise decisions. In other words, he must have

## THE MAKING OF AN EXECUTIVE

a clear knowledge and understanding of the finances of the business.

**2. Elementary Basis of Finance.**—The sum and substance of a commercial enterprise consists in a series of transformations of values. A new business, starting from the ground up, involves as most fundamental elements, *cash*, or its equivalent in a bank credit, and *ownership*. Ownership may take several forms. It may be the simple ownership of the man starting the business, with money that he has saved up or has been left by will; or, the ownership may be represented by the money paid in by two or more partners; or, it may be ownership vested in a number of persons who have received stock certificates to vouch for the extent of the ownership of each. However complex the mechanism may be, the two factors must be there. There must be capital, that is, cash or its equivalent; and there must be ownership of this capital, whether vested in one person or in many persons.

**3. Transformation of Values.**—If a business starts from a basis of cash and ownership, what exactly is the state of affairs at the expiration of the first six months, say? The first thing that an inspection would disclose, is that the amount of cash (or bank deposit) has become very much smaller than it was at the start. A large amount of cash would be seen to have disappeared. On the other hand it would be found that the business possessed certain things entirely new, as, for example, a quantity of machinery; a store room full of material; in the factory, work lying around in partly finished condition, as work-in-process; in the stockroom, some finished product ready for the customers, etc. The fact is that cash has been changed into goods. What was originally cash in bank has been paid out for the purchase of equipment and raw material; some of the cash has been expended in wages, which in their turn have been transformed, along with some material, into partly finished and wholly finished product. Nor is this the whole extent of the change. The things just enumerated as resulting from the expenditure of cash,

can be seen and touched. But, under conditions now to be described, part of the original cash is represented by assets in a form that cannot be seen or touched.

**4. Unseen Assets.**—If the value of the items enumerated in the preceding article were summed up, and to the total were added the cash left in the bank, it would be found that all the items together would just equal the original cash, and, consequently, would equal or balance the statement of ownership. This method of reckoning up the status of a business should be noted. All the items of property that can be found are added together and then compared with the total value originally ascertained as ownership. Property at any time must equal ownership, or it becomes evident that a loss has been incurred. The end and aim of all accounting, and therefore of all bookkeeping, is to set up a comparison between ownership on the one hand, and on the other hand property, technically called *assets*, after allowing for all debts owing to the company.

To come back to the example considered in the preceding article, if, after the lapse of further time, beyond the six months originally contemplated, the business has progressed to the stage of making sales on credit to customers, it will soon be found that some property exists in a form that is not visible or tangible. Goods have been sold and are therefore no longer in the stockroom, but in their place appear *book debts*, or *collectible accounts*, that is to say, amounts of money owing to the firm by customers. On totaling these amounts and adding to the total the visible and tangible property, it will be found that the new total of all property will aggregate to more than the original statement of ownership. The meaning of the increased total property is clear. It signifies that a profit has been made. Such a profit is technically called a *surplus*, for the reason that it is the amount in excess, or in surplus, when ownership and assets are put side by side.

**5. Profit and Loss.**—The whole process of business has now been reviewed. First, there is cash and ownership.

Then sundry changes of condition or status of values take place; one kind of value disappears and its place is taken by another kind of value. Finally, a line is drawn at some definite point, or date, and all the different kinds of values found are collected and enumerated and summed. The total so obtained is compared with that of ownership. It is evident that one of three conditions must then obtain. Either the new values, or assets, fall short of the ownership, or they equal it, or they exceed it. These three conditions correspond, respectively, to (a) loss, (b) neither loss nor profit, (c) profit. It hardly needs to be pointed out that the source of the surplus lies in the excess of money paid (or appearing on the books) for product sold, as compared with the money spent in making it.

**6. Work of the Executive.**—To recapitulate, the essential course of business consists in a series of operations, or transformations of values, starting from a basis of cash and ownership, going through the stages of purchasing equipment and raw material, hiring labor, etc., working on the material to convert it into partly finished and ultimately into finished product, and, lastly, selling, with a view to creating a surplus. Finance is the art of distinguishing the various values in the process of transformation, disentangling them from whatever tends to obscure them, and then so arranging and marshaling the figures that a judgment can be formed as to whether all changes are in the right direction. The task of the executive is to watch the process closely, and to keep in touch with the changes in value in such a way that any tendency to transform cash into the wrong kind of values is detected in time to prevent disaster. Conversely, the duty of the executive is to make such decisions, based on what is revealed by the financial statements, as will steer values into the right direction, so that the changes continually going on will ultimately be found to yield not only surplus, but profit. For these two terms do not necessarily mean the same thing. Surplus is profit only when it is in a form withdrawable from the business as cash, and distributable as dividend. By such

withdrawal and distribution property or assets and ownership are again restored to equality, surplus being subtracted from one side of the account and cash from the other, thus preserving a balance.

**7. Difference Between Surplus and Profit.**—The practical difference between surplus and profit cannot be too strongly emphasized, because it is a snag on which many businesses are wrecked. *Profit is distributable surplus.* Where receipts are in the form of cash from customers, all surplus may be originally distributable, and profit and surplus are in such case identical. But, in general, surplus does not remain distributable, because it may be converted from cash into goods or equipment, buildings, etc.; in other words, the profit may become *absorbed* in investments that cannot, at a moment's notice, be converted into cash. In such a case, a part or the whole of the *surplus* may cease to be distributable, and may no longer, therefore, be *profit*.

It must be remembered that profit is not put on one side and kept separate from the other values. It is or passes into cash as it is received from the customer, and may then immediately set out on a series of transformations just like any other kind of cash. In this way it may happen that at the end of the financial period, surplus may be represented by goods and not by cash. It may even happen that a firm actually has to borrow cash in order to turn its surplus into a distributable form. This in itself is no evil, if the forms of property that have absorbed the profit are in themselves ultimately valuable to the business. But what happens if they are not? Under what conditions can it be said that surplus is not distributable profit?

**8. Undistributable Surplus.**—Suppose that profit has been absorbed in the purchase of new equipment. It is apparent that this is an expenditure beneficial to the business. It may prevent the declaration of a dividend, but the property of the firm is more valuable than before. Or, on the other hand, sufficient cash may be in hand to permit of the distribution of a small dividend, while the greater part of the surplus

is locked up in other forms than cash. The question arises as to how the undistributable surplus is to be designated on the balance sheet. This balance sheet may be set up in the form shown in Fig. 1.

<u>Assets or Property</u>	<u>Ownership</u>
Cash	Capital accounts
Stores	Reserve
Work in process	Surplus, distributable
Finished product	
Equipment	
Collectible accounts	

FIG. 1

It will be seen that an item *Reserve* appears on the Ownership side of the sheet. Under this head that amount which is not distributable as dividend is placed. Ownership has now two divisions: first, the ownership of the original capital appearing as the item *Capital accounts* on the balance sheet; second, the undivided ownership of reserve. After the balance has been struck, an amount of cash equal to distributable surplus is taken out of the bank and sent to the owners of the business as dividend, and this wipes out the entry Surplus on the sheet, and leaves assets or property on the one hand, and ownership on the other, as before, but now this ownership is in two forms. The old form is that in which each owner has a defined share represented by his stock certificates. The new form is one in which the ownership is *common*. The property belongs to all the owners collectively. What is termed "cutting a melon" is, in fact, usually simply the releasing of a reserve that has been accumulated over a long period, and its distribution pro rata over stock holdings, usually in the form of new stock, more rarely in the form of cash.

**9. Unrealizable Surplus.**—In the case just cited, the property in which the surplus or reserve was absorbed is to

be considered as ultimately beneficial to the business by putting it in a position to make larger profits. Though not immediately realizable as dividend, the surplus is expected to be so ultimately. But if the management of a business is not good, it may happen that surplus is represented by some form of property that is not ultimately realizable, and can never be turned into an equivalent of cash, or distributable profit. This may come about in a variety of ways. Unfortunate purchases of material may be made; half-finished parts may be produced in such a way that there is a great excess of some of them; finished goods may be put into stock for which further experience shows there is no demand; equipment may be purchased that is found to be unsuitable for its purpose. Further, some of these situations may come about without any positive error of judgment on the part of anyone. Demand may change suddenly, so that work in process and finished goods do not represent ultimate salable values. New inventions may cause existing equipment to become so obsolete as to necessitate immediate renewal. In such cases, if the unwanted goods or the old equipment is carried in the balance sheet at the former value, a surplus will be shown, but it will be an unrealizable surplus. It will be based on a false valuation of existing property, although this falsification may be an unconscious one. This point is very important and calls for further discussion.

**10. Inventories and Valuation.**—It is evident that the two sides of the balance sheet shown in Fig. 1 will balance only on the condition that the amounts paid for property are set down exactly as so expended. In other words, if \$50,000 has been spent on equipment, that amount must stand in the list of property against the item of equipment. Similarly with the other items. The making of a list of property for the purpose of a balance sheet is called *making an inventory*. Unless all the property is included in the inventory, the assets obviously cannot balance ownership, and they can so balance only if included at their cost price. Now, circumstances may arise when the cost price at purchase no longer represents the

true value at the time of taking inventory. What is to be done in this case? How is the loss of value to be faced and dealt with on the balance sheet? It is evident that a correct balance sheet, and therefore a correct ascertainment of surplus, can be obtained only by setting correct *current* values against each item of property. From this it will be seen that a balance sheet is not merely an arithmetical check on the accuracy of the accounting. Its preparation involves questions of policy that demand the very closest attention from the executive himself.

**11. Depreciation.**—One of the most common ways in which the values in the inventory of property cease to correspond with actual values is by wear and tear of equipment. All equipment, including buildings, wears out by use. Experts have studied this rate of wear, and for each class of equipment there is a recognized rate at which the value of such equipment is reduced year by year. Loss of value by wear and tear is called *depreciation*, and the percentage of value that disappears each year is called the *depreciation rate*. Now, if no provision is made to reduce the value of equipment in the accounts in proportion to its depreciation, a time will come when its condition is such that renewal is imperatively required, and there will be no fund to meet the renewal. Very many businesses have come to grief in just this way. Depreciation has been ignored or provided for to a wholly insufficient extent; dividends have been paid out up to the full earning power of the business; consequently, when the equipment no longer suffices for economical production, there is nothing left in the business to meet the strain. Unless new capital is supplied, there is no alternative but to wind up and sell out.

**12. Providing Against Depreciation.**—While the actual bookkeeping arrangements necessary are beyond the scope of this discussion, it may be desirable to indicate the means by which depreciation and allied losses are provided for. Whenever a loss is incurred, it must be written off the books. This may be done in various ways, but most easily by



charging the amount to Profit and Loss. The effect of doing this is to reduce surplus; that is, when surplus is set down in its proper place on the balance sheet, it will be less than it would otherwise have been, by just the amount of the loss. Now, if the loss is in the nature of depreciation, and the equipment stands at its original value in the list of property or assets on the balance sheet, this sheet will fail to balance. In charging off the loss, therefore, a credit must also be made to something. The usual thing is to credit a *depreciation account*. This account represents, at any moment, the amount that has been charged off, and it may be regarded, in a way, as representing the common ownership of that portion of equipment that has been used up. If, then, the amount is placed on the right-hand side of the balance sheet, as a depreciation reserve, as in Fig. 2, it will be found that the sheet again balances.

<u>Assets or Property</u>	<u>Ownership</u>
Cash	Capital account
Stores	General reserve
Work in process	Depreciation reserve
Finished product	
Equipment at original cost	
Collectible accounts	Surplus (distributable)

FIG. 2

The depreciation reserve and the surplus, together, come to what the surplus alone would have amounted to if depreciation had not been subtracted from it by being charged to Profit and Loss. But as this portion of the reserve fund is not distributable, and is, in fact, reserved for a special purpose, namely, the ultimate renewal of equipment, it is not placed in the general reserve, but labeled Depreciation Reserve, to earmark its future use.

**13. Writing Off Losses.**—The same treatment that is applied to the slow and regular loss by depreciation is also applied when any sudden loss is incurred. The amount lost must be written off in Profit and Loss. But it does not follow that a reserve is always set up. The loss may be one that has to be met once for all. Consider the case of a quantity of spoiled stores or materials. Their value has vanished. To include it in the balance sheet would be to falsify the latter by showing a greater surplus than was actually existing. But, if the loss is written off by charging it to Profit and Loss, and Stores is credited with an equal amount, not only will the surplus be reduced, but also the item Stores. So that when all items meet in the balance sheet, it will balance, since the lowered value of Surplus is countered by a correspondingly lowered value of Stores.

It possibly may be asked why, in the case that was dealt with in the preceding article, the value of equipment should not have been simply reduced in like manner instead of making use of a separate and artificial account entitled Depreciation. The answer is that it could have been so treated, but that the usual practice is as described, for the reason that it is well to have always before one the exact relation of the respective values of equipment and the extent to which provision has been made for its renewal. These face each other on the balance sheet, and can be compared. If depreciation simply were written off equipment account, the relation of the two would not be clearly brought out.

**14. Liquid Assets.**—It has already been mentioned that the executive must keep watch on the nature of the assets that are inventoried in the balance sheet. These assets must always be live values, and may not include any obsolete or ineffective property. Any such, when discovered to exist, must be removed by being written off or charged to Profit and Loss as already explained. But the executive has also another task. Though all assets may be live and effective, it is still possible to bring the business to a standstill by not having a sufficient amount of quickly moving assets. In other words,

capital may be locked up too much in equipment and materials, so that there is not sufficient liquid capital to carry on the business. Under such conditions, unless a loan can be raised on the security of such forms of capital as exist, the business will come to a stop. One of the main responsibilities of the executive, therefore, is so to guide operations that cash and collectible accounts, and to a less extent finished goods, bear a sufficiently large ratio to the rest of the assets. It is only from the quick movements of these items that sufficient funds are forthcoming to provide for wages, salaries, and other current expenses of the business. Thus, assets can be divided into two classes, liquid and fixed. This is somewhat arbitrary, but the meaning is generally clear. Besides actual cash, liquid assets are those that readily and rapidly change their form into incoming cash. Fixed assets are those, like machinery, and most raw material, in which the movement towards the phase of cash is comparatively slow. Unless there is a sufficient proportion of liquid assets, it is clear that one morning there will be no cash in the drawer and no balance at the bank.

**15. Liability Side of the Balance Sheet.**—The balance sheet is the final stage of accounts, and represents the court of appeal that decides what the result of the period's trading has been. It is a cross-section cut through the business at any moment, and shows the actual status of all the different kinds of property possessed by the firm at that moment.

Something must now be said about the right-hand side of the balance sheet. Hitherto this has been considered in its principal function of exhibiting the distribution of Ownership. In practice this side of the sheet is commonly called, not the Ownership, but the *Liability*, side. This requires explanation. The matter is simple if the right viewpoint is adopted. The balance sheet is a list of property, primarily. It is an inventory of a business, of a particular business. But more especially it is a statement by the *management* of the business, not by the owner. Consequently, it has to show on

the one side the inventory of assets; on the other, just to whom the management is liable, or to whom it is responsible, for the care of these assets. This liability of the management may be to a single owner, or to many owners, but it is always a liability. So much for the explanation of the term. Now the question may be asked why money that is owing to other persons—to creditors of the firm—appears on the same side as the statement of ownership or liability to the owner. One way to regard the matter is that money owing to the creditors is a liability of the *management* towards those persons. To them it owes money; to the owner it is liable, not for cash, but for property. Both are liabilities, but of a different kind. Another way of regarding the matter is to consider that in a limited sense the creditors of the company are virtual owners of the property of the company, to the extent of their claims. They appear alongside the other owners, because they have a lien on the assets just as these have. If the owners, as represented by capital account, have a claim on the assets, so have the creditors, as represented by the statement of money owing to them. Thus it will be seen that liability is a perfectly rational name for this side of the account. It is always the management of the business that is liable, not the owners. This is clear enough, when a corporation is in question, because then the stockholders are obviously outside the business. But when it happens that owner and manager are one and the same person, the situation is obscured. The fact is that, even when the owner is the one that prepares the sheet, he prepares it in his function of manager, and is liable to himself in his function of owner. Clear understanding of this is very important.

**16. True Appraisal of Values.**—A balance sheet is, as has been pointed out, primarily a list or inventory of assets and liabilities. Beyond the setting up of a correct itemized list of such property and its ownership, therefore, the compiling of a balance sheet does not necessarily require any bookkeeping. But in the absence of bookkeeping, every item would have to be *valued* by some expert who was capable

of assigning the correct valuation to each item of stores, materials in process, finished goods, equipment, etc. In some cases, where, for example, a business is to be sold, this is actually the manner in which the balance sheet is made out. Even the collectible accounts due from customers would be subject to the appraisal of the valuer, since some of them might not be considered as good as cash in hand. But under ordinary circumstances this method would be too costly, and would involve too great a break with current history to be useful. In a going concern, the balance sheet is the final arithmetical test of the correctness of the accounts. If all postings have been correctly made, the sheet will balance; if not, it will not. But, as before remarked, an arithmetically correct balance sheet is not necessarily a true one. It is only true when the true value of the property corresponds exactly with the book figures. This is not a matter of bookkeeping but of executive decision. The responsibility rests on the executive for this true appraisal of values, and the accountant, or even the auditor, does not share it. It is frequently forgotten that an auditor's certificate rarely covers more than arithmetical correctness of the balance sheet and the accounts from which it is made up.

**17. Interim Balance Sheets.**—When a balance is made up, it is too late to take steps to remedy any unfortunate conditions it may reveal. This is an argument for frequent balance sheets. In the old days, before perpetual or continuous inventory was in use, the value of stores, work-in-process, and finished goods could only be ascertained by actual count and valuation. This meant, generally, the stoppage of production for a period of from one to seven days. Consequently no attempt was made to prepare a balance sheet oftener than once a year, or twice a year at most. But nowadays, since the value of each item is known from day to day, there is nothing to hinder the preparing of a balance sheet at least once a month. Such balance sheets are called *interim balance sheets*, and though they are in some degree unofficial, being intended for the use of the executive only,

and not for that of the shareholders, still they are sufficiently exact to enable one to ascertain the main changes in the status of values. By their aid the executive can find out what is going on, in time to modify any unsatisfactory trend, such as a piling up of half-finished work. The correctness of the interim balance sheets is finally checked by the regular yearly or half-yearly balance sheet, officially compiled and audited. In all cases the agreement should be close, leaving at most an insignificant difference.

**18. Conclusion.**—It has now been made clear that a balance sheet is a representation of the supposed status of all the property of the firm at any one time, compared with its supposed liabilities to creditors and owners. The word *supposed* is here used because, except for the vigilance of the executive, there is no means of ascertaining that the figures or values shown by the accounts do in fact correspond to the true values. Since there are certain conditions under which such correspondence with the truth may not obtain, it is necessary to consider the means open to the executive to satisfy himself that these conditions are provided against. Hitherto the discussion here has related merely to property in various forms, without examination of the process by which one kind of property is transformed into another. It has been observed that cash is transformed into stores, work-in-process, finished goods and equipment, but nothing has been said as to *how* this takes place. The balance sheet is always past history. It becomes necessary to consider current history, or, in other words, to observe the various forms that expenditure takes from day to day.

#### CONTROL OF EXPENDITURE

**19. Use of Accounting.**—Whereas the main object of bookkeeping is to record the details of what happens, the main object of accounting is so to arrange and combine the details thus recorded, that effective control over expenditure is obtained by the executive. It will readily be understood,

from what has been said in the previous articles, that the various and successive phases through which cash passes in its progress from the original bank deposit to its reappearance in the form of a customer's check, are controlled by expenditure. Each stage in the cycle is marked by expenditure, so that if care is taken that no expenditure or class of expenditure is made without due authority, such control of expenditure by the executive will in itself constitute very effective control over the forms or phases that property assumes. In the present section the main avenues of expenditure will be discussed, the changes of values to which they give rise, and the manner in which executive control may be exercised so as to steer events in the right direction. In the first place it may be well to explain the difference between *expenditure* and what is technically known as *expense*, the two terms being often confused.

**20. Expenditure and Expense.**—Any payment whatever is an *expenditure*, but only certain kinds of payment come under the technical description of *expense*. Thus, the purchase of a machine or the erection of a new shop in the productive department is an expenditure, but it is not in any sense an expense. On the other hand, a contract for window cleaning is an expense; so is a purchase of postage stamps, or a check in payment of an electric lighting bill. Broadly speaking, an item of expense is one leading to the acquisition of something that is not lasting property, something that is intended for immediate consumption, as in the case of postage stamps. To make the matter clearer, various kinds of expenditure may be enumerated. Thus, the purchase of equipment, of raw materials or stores, and of productive labor are none of them expenses. They are all chargeable ultimately to product. But everything that is purchased and does not go directly into product is of the nature of an expense. Thus, all office salaries, stationery, and petty cash items are expense. So are purchases of coal, wages of firemen and engineers, etc., in the power plant. The whole expenditure on the selling department is an expense. All material used in repair-

ing, and all labor employed on it are expense. None of these wages or these materials go directly into product. They form no part of its direct cost. But the important point to remember is that each and all of them have to be paid for out of the difference between flat cost of product and the price obtained for it from the customer. Only by sales of product can profit arise, but such profit, under unskilful management, may be wholly absorbed by expense.

**21. Complexity of Expense.**—While all expenditure is important and needs control, that particular kind of expenditure known as expense is one of the most complex and difficult subjects with which the executive has to deal. It is probable that more businesses get into difficulties through the wrong handling of expense than from any other cause. This is particularly the case where several different lines of product are manufactured alongside one another in the same plant. To allot to each its proper portion of expense is a problem that taxes the art of the cost accountant to the utmost; but unless this problem is correctly solved, misconception may arise as to which of several lines of product is the most profitable. Strenuous efforts may be, and frequently are, made to push the sale of some one line of goods that is really being produced at little or no profit, while the really profitable articles are being neglected. The discussion here will be restricted to the expense as it arises in different departments, omitting the internal details of the distribution of such expense within the department.

**22. Distribution of Expenses Over Products.**—It may be desirable briefly to call attention to certain simple underlying principles that govern the distribution of expense among different kinds of product. On analyzing the situation it will probably be found that certain expenses are confined to certain products. Where this is the case, such expense should be prorated over that product alone. Thus, in a machine works, the cost of patterns is obviously a matter concerning castings alone. On the other hand, the expense of material-



stores and tool-rooms has nothing to do with castings, but is confined to machines alone. Certain lines of product may necessitate the upkeep of a drafting room, and the cost of this should not be allowed to mingle with the cost of other products not requiring such service. The expense of the sales department may require to be dealt with along similar lines. One product, for example, may require extensive advertising, or may have to be handled by salesmen who are technical experts, while other products in the same plant are sold as staple articles to the jobbing trade. It is evident that the latter article must not bear any of the special expense due to the former product. These cases will serve to show the principles to be kept in mind, but it is not possible here to do more than call attention to the occurrence of such conditions.

**23. Varieties of Expense.**—The principal groups of expense may be enumerated as follows: Purchasing and storekeeping; power plant; factory; selling; office; and general. From what has already been said, it will be evident that all these different kinds of expense must in some way become attached to product and form part of its cost, since it is only by the profit realized on the sale of product that any of them can be paid for. That is to say, if the flat cost (direct material plus direct labor) of a unit quantity of product is \$1, sufficient must be added to this dollar to cover all the different classes of expense enumerated, in order to find the true cost, on which to base a selling price. The process of connecting expense with unit value of produce is called prorating. It is usually done on a percentage basis, although this method is correct only under certain circumstances. Thus, the situation may be described by saying that shop expense is 25 per cent. above flat cost, or that selling is 5 per cent. above flat cost, and so on. Once established, such percentages also form a species of control, because it is an easy matter to arrange the accounting so that the percentage of the different classes of expense to flat cost is ascertained at frequent intervals. A rise or fall in the percentage then indicates that changes are taking place in internal conditions.

**24. Auxiliary Nature of Expense.**—It has been shown that the final test of business success is found in making inventory of assets and liabilities, and thus finding what changes have been produced in the status of the different kinds of property since the preparation of the last balance sheet. Now, the peculiar nature of expense is this: it does not directly change the status of anything or add to any values. Only a productive act can do that. All expense must therefore be directed to helping either production or sales. Any item of expense that is not auxiliary to one or other of these activities is wasted. Of course this statement must be taken with reserve. The act of washing windows may, at first sight, seem unconnected with either activity. Actually, however, such an act assists either production, if it is the factory windows that are being cleaned, or selling, in the case of office windows. From this elementary instance one of the difficulties of the expense situation may be gathered. The difficulty is to observe just what bearing each item of expense has on the two main lines of effort of the business. Since hardly any expense is directly measurable as to its effects, it is frequently difficult to determine whether a given expense is justifiable or not. Thus, to wash windows once a month may be justifiable, and directly auxiliary to better production; but to wash them every day would be a waste, although the expense would be charged against production just as though the expenditure were necessary.

**25. Multiplicity of Expense Items.**—Not only is the problem of expense complex in its distribution over production or selling, but it is made up of a multiplicity of small items, all of which need constant watching if they are to be satisfactorily controlled. In a plant of any considerable size the different items of expense may number hundreds. It is therefore evident that they cannot be dealt with individually, but must be grouped in some way, so that they are dealt with in aggregates. These aggregates must have some close relation with one another. The first step is therefore the analysis of expense. This is assisted by the fact that a large propor-

tion of expense items will be seen to fall naturally and unmistakably into certain groups as enumerated in a previous article. The salary of a salesman is obviously an expense of the selling department; the wages of a fireman belong to the power-plant expense; and so forth. But some expenses are not at all obvious in their distribution over departments. This statement applies, for example, to the salaries of higher officials who may give their time in varying proportions to production and selling problems; and the same is true of the large item of office expense, which, although easily segregated, has still to be allotted either to selling or productive expense. After analysis, therefore, comes the necessity of grouping, so that finally the whole expense of the business is allotted to or divided between the two main activities, production and selling.

**26. Building Up Selling Price.**—A clearer view of the part played by expense in business operations will be gained by considering the components of selling price. The manner in which a sale price may be considered to be built up, is exhibited in Fig. 3. First, the cost of the material entering into the product is taken; second, the direct labor expended on production; third, factory expense, made up of all kinds of items, including salaries of superintendents, foremen, cost of light, heat and ventilation, power consumed by the factory, cost of repairs to buildings and equipment, expense of purchasing and of storekeeping, depreciation of

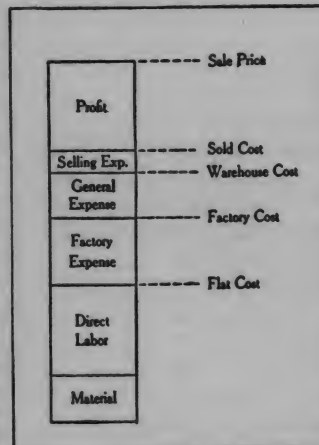


FIG. 3

buildings and equipment, etc. The three main components, added together, form the factory cost of the product. To factory cost must then be added general expense. This component is made up of salaries of executives, office salaries and expenses, accounting expenses, cost of credit and collection department, etc. But some of these items are not charged in total to general expense. On the contrary, they are divided between general and selling expense, wherever it seems fair that the latter department should bear a share. When general expense is added to factory cost, the resulting value is that of the goods in stockroom or warehouse. Finally, they have to be sold. Therefore, to stockroom cost is added selling expense, giving the cost of the product *as sold*. Next, the profit to be made is charted, and this, when added to the previous total, gives the selling price of the goods.

**27. Outline of Expense Control Method.**—From what has been said in the last article and from inspection of Fig. 3, it will be understood that though the separate items of expense may be very many, each has a definite place in regard to its effect on the ultimate cost of the product. Each belongs in its own group and affects the cost in that group only. This will suggest that a first line of control can be set up by recording the cost of product at each of the stages demonstrated by Fig. 3. In this way the whole series of activities is split up into divisions, each of which has a separate efficiency that can be watched on its own account. If the total activity is producing results that are not perfectly satisfactory, it is an easy matter to locate the approximate source of the trouble. If, for example, there is a falling off in profits, and the factory cost of the product nevertheless remains steady, the fault will have to be sought higher up on the scale in Fig. 3. If warehouse cost appears unchanged, then the trouble must be located in the selling department. This will be confirmed if it is found that selling cost has increased. Feebleness in the selling department is thus isolated from other causes, and similarly, a falling off in efficiency in the factory will be at once reflected in a rising factory cost.

**28. Service Departments.**—Certain departments, as, for example, the power plant, and the purchasing and store-keeping department, though enumerated as among the principal sources of expense in the foregoing, are nevertheless not represented on Fig. 3. This is because such departments exist merely to perform service to other departments. To consider the power plant as an example, the total cost of this department is wiped out by charging it in part to production and in part to office expense. The factory pays for the power and light that it has consumed; the office, for lighting, and possibly for power in working elevators, etc. In technical language the cost of the power department for a given period, say a month, is first found separately, and then prorated over other departments in proportion to the service enjoyed by each. Similarly, the services of the purchasing and store-keeping department will be wholly charged to production, unless, as may sometimes happen, it buys goods for resale. In that case a share of its cost would be prorated to the selling department. The principle will be clear. First, the total cost of the service is segregated, and then the situation is examined to see who has enjoyed the benefits. Charges are made accordingly, so that the whole cost is accounted for by such prorating.

**29. Material.**—The expenditure on material represents a new class of transaction. Hitherto there have been considered only those varieties of expenditure that are obviously expense. Material, however, has this peculiarity, that at the time of purchase it is often impossible to say whether such material is to be used for service purposes, say for repairing equipment, or is to find its way into product. A third possibility, to be discussed later, is that material may be destined to become part of a new machine or other piece of equipment, and thus form an item neither of expense nor of product, but of new capital. In practice this difficulty is overcome by considering all material purchased as an asset, until it is actually used. As an asset it will appear in the balance sheet under the head of stores. When it is used it is credited to stores account and disappears from the next balance sheet.

It is then charged to expense, or product, or new machinery as the case may be. Here, then, is an example of an expenditure that is not expense, but that, notwithstanding, requires very careful watching. The executive must watch that the value of material kept in stores does not become inflated beyond the needs of the business, because this is equivalent to tying up capital in a fixed form, and removing it from the class of liquid assets.

**30. Pay Roll.**—What has just been said about material sometimes applies with equal force to the pay roll. In some, perhaps in most plants, the pay roll can at once be analyzed into production and expense wages. Frequently, however, it cannot be, or only a portion of it can be so analyzed. In a machine shop, for instance, a man may be employed indifferently on production, or on repairs, or on the construction of a new device for the use of the shop. But there is this difference between material and wages. The latter are not paid until they have been expended on some definite work. In other words, the time sheet of the worker will indicate how his time has been applied. The first thing to be done with the pay roll, therefore, is to make an analysis of the way in which the wages have been expended. Then product will be charged with its share, and the amount chargeable to expense will be set forth in tabular form, so that the executive can observe increases or decreases in each item or grouping.

**31. Outside Services.**—Many items of expenditure are related to *outside services*. Thus, insurance of several different kinds will be carried by the firm; auditors and other experts will be employed; legal expense will be incurred; advertising will be paid for, etc. In all these cases nothing tangible is received in return for the expenditure. It is a service that is purchased. Payments of this class will need analyzing also. They are nearly all in the nature of expense items, but care must be taken to make the distribution correctly. Thus, advertising is naturally to be charged to the selling department; but insurance will have to be split up and charged in detail to those departments that enjoy its benefits.

**32. Additions to Value.**—In most plants new machinery and equipment are simply purchased and charged to equipment account, thus appearing in due course on the balance sheet as part of that item. But in engineering plants and machine shops, additions to equipment, or, as technically termed, to *value*, are made in another manner. Equipment of various kinds is made or built in the shops exactly as if it were product to be sold. It is, in fact, treated in all respects like product, from an accounting viewpoint, until completed. Then, instead of being charged to store room, it is charged by means of a journal entry to equipment, or more usually to an Additions to Equipment account. It thus reaches the balance sheet in due course, precisely as though it had been purchased from outside. Such items do not, of course, take any percentage for selling expense, and some accountants contend that no general or office expense should be charged, either. This, however, is a disputable point.

**33. Cross-Classification of Expense.**—Although expense comprises a very large number of items, it arises in most cases from a few main sources. This will be easily understood by considering the few forms of expenditure. Expenditure is mainly made up of material and pay roll. If to these two classes is added payment for outside services and for rent and taxes, nothing of much consequence is left. One item of expense, and in some industries a very heavy one, must not, however, be forgotten, although it is not an actual expenditure, in the sense of being paid out in cash. Depreciation has to be systematically charged into expense, to provide for the slow wastage of buildings and equipment. Even then the actual sources of expenditure are very few, and therefore easily controllable as to their totals. If, then, a tabular statement is set up showing the total from each of these sources for, say, a month, it will be easy to insure that the various departments have been charged with their due proportion. A statement of this kind is shown in Fig. 4.

**34. Statement of Distributed Expense.**—In the chart reproduced in Fig. 4, the main sources of expense and

ITEM	AMOUNT	REPAIR DEPT	POWER PLANT	OFFICE	GENERAL	FACTORY	WAREHOUSE	SALES DEPT
Material on Expense Jobs	\$ 110.00	\$ 110.00						\$
Office Supplies	12.00			12.00				
Wages on Expense Jobs	150.00	150.00						
Salaries	1750.00	50.00	100.00	400.00	200.00	250.00	50.00	700.00
Outside Services	150.00				50.00	50.00		50.00
Rents and Taxes	450.00	20.00	30.00	40.00	10.00	250.00	50.00	50.00
Depreciation	235.00	20.00	30.00	10.00	10.00	150.00	10.00	5.00
Grand Total	2837.00	350.00	100.00			250.00		
of Amount to be Distributed		Total Repair	Total Power					
			Service	30.00		200.00	15.00	15.00
			Total Office	492.00		292.00	100.00	100.00
			Total General		270.00	100.00	20.00	150.00
			Final Distribution Totals		1542.00		245.00	1070.00

FIG. 4



the amounts of the several items are assembled in the first two columns on the left side of the statement. The rest of the blank is made up of columns each of which is allotted to some department. In the illustration the departments indicated are: Repair Department, Power Plant, Office, and General Expense. These four columns form a group. The remaining columns are headed Factory, Warehouse, Stockroom, and Sales Department. Item by item the amounts appearing in the first column are allocated to the departments benefiting by the expense, as ascertained by the cost and general accounting. Then, when all items have been thus allotted, each column in the first group of four columns is totaled, and each of the totals so obtained is distributed in the same manner as the separate items before, and on the same basis, over the columns to the right of such total. So, for example, in the chart the total in the column headed Repair Department is \$350. It is obvious that the repair department is maintained not for its own sake but for the benefit of the other departments appearing on the chart. Therefore, the expense of the repair department is properly chargeable to the various departments benefiting. The illustration shows that \$100 of the repair expense is charged to Power Plant, and that \$250 is charged to Factory.

The total of the next column, headed Power Plant, includes the \$100 charge from the repair department, and amounts to \$260. What has been said of the repair department is true also of the power plant, namely that this plant is maintained for the benefit of other departments. Therefore the total charge of \$260 is properly chargeable to other departments. The chart shows that \$30 is charged to the office, \$200 to the factory, \$15 to the warehouse, and \$15 to the sales department.

The same principle applies in distributing the totals of the other two columns of the first group, so that the total expense, as shown at the foot of the first column of figures, eventually finds its way to the final distribution totals appearing at the foot of the last three columns of the table.

On referring back to Fig. 3 it will be noted that these three columns correspond to the three stages of cost there shown,

namely, Factory Cost, Warehouse or Stockroom Cost, and Sold Cost. It should be mentioned that what is here termed warehouse cost is often merged with factory cost, by adding a percentage of general expense to factory cost. The method here outlined is, however, preferable.

#### MANAGEMENT OF FINANCES

**35. Importance of Clear Statement.**—A complete understanding of the condition of a business of any considerable size cannot be obtained by the executive without accurate bookkeeping and accounting. Even when these are present it is still necessary for the information to be worked up and brought out in such form that it can be swiftly and readily grasped, and that the necessary deductions can be made without undue trouble. The advantages, to the executive, of a proper system of statements and accounts, are therefore clear. But in many cases more than this is gained. The matter is well stated in the following extract from a circular issued by a leading banking firm: "When the man of business goes to his bank . . . he takes with him his financial statement. His banker draws out full information about the condition of the business . . . he also forms a judgment of the character of the management of the business. If there are weak spots in the statement, the banker is usually able to put his finger on them. He may recommend a reduction of inventories to bring them in better relation to amount of sales and capital invested. He may criticize the amount of outstanding obligations in proportion to liquid or quick assets."

**36. Preventive Uses of Statements.**—A properly arranged series of financial statements is as necessary to the management of a business as a set of charts is to a captain in navigating a ship. And just as the ship charts are unintelligible to those who have not been trained to read them and interpret their signs and marks into terms of navigation, so it is equally true that the best financial statements will be of little service to an executive who has not grasped the essen-

tial principles on which they are constructed. The object of such statements is very clearly stated in the extract quoted in the preceding article. It is to enable the executive or any other person, such as a banker or a financier that he takes into his confidence, to lay his finger on the weaker spots of the business. But this is not all. As the executive is daily and hourly in touch with his business and with the statements of various kinds that are put before him, he should be able, not so much to detect the weak spots as they appear in a balance sheet, but to prevent the development of any such spots at all. Just as the object of the ship's chart is to enable the captain to avoid shoals and hidden dangers, so the purpose of financial statements is to enable the executive to steer his business past the perils that beset all enterprises, and to guide it on a safe course.

**37. Range of Discussion.**—In the previous article it was shown how the final test of success in business operations is to be found in an observation of the status of the different kinds of property owned by the firm. If this property is more in amount than the liability of the management to owners and creditors, a surplus is implied. This surplus is in some cases or in some proportion distributable profit; in other cases it is not immediately distributable. It was also shown that not only the *amount* of the property or assets is significant, but also its *make-up* or condition as regards fluidity. The necessity of a due proportion of liquid or quick property to fixed forms was demonstrated, and this is one of the points mentioned in the banker's circular quoted. Then it was shown that a number of items never appear in a balance sheet at all, but are only known by the effect produced on the forms of property in the interval since the last balance sheet. These items are those known as expense. The articles that follow will discuss the several statements that should be prepared for the use of the executive regarding these matters, and will show how such statements should be read and acted on to insure that the fullest use will be made of the information they present.

BUDGET 1921		January		February	
1. FACTORY	PAYROLL	Expected	Actual	Expected	Actual
	Productive				
	Non-productive				
	Superintendence				
	General Labor				
	Clerks, Timekeeper				
	Repairs				
	Spoiled Work				
	MATERIAL				
	Productive				
	Non-productive				
	Repairs				
	Spoiled				
	Other				
	TOTAL LABOR & MAT'L				
	Productive				
	Non-productive				
	Share of Power Plant				
	Share of Insurance, etc.				
	Depreciation				
	Total Factory Expenditure				
	Charged in Cash				
	Idle Time Account				
	2. OFFICE				
	Salaries				
	Janitors, Messages, etc.				
	Supplies				
	Post and Telegram				
	3. SALES DEPT				
	Salaries, Home Office				
	Salaries, Outside				

**38. Budgeting Expenditure.**—One of the most satisfactory methods of controlling expenditure is by the method of budgeting. By the use of this method one of the great dangers of careless management of finances is obviated, namely, the sudden emergence of a forgotten or overlooked item of urgent importance at a time when the business is least able to find ready money. The principle of budgeting is a simple one. It consists primarily in listing all items of expenditure in advance of their maturity. But this alone would not be of much service, because items might well be forgotten even then. Budgeting is nothing less than the systematic forecasting of the financial status of all divisions of the business. For this purpose, each department is gone over with a fine tooth comb, and all possible avenues of expenditure are listed. The previous year's accounts are called on to provide information. In the case of a new business, an experienced cost accountant should be relied on to make up the first budget, which should, moreover, be submitted to the scrutiny of all heads of departments, so that no item shall be omitted. It will readily be understood that an imperfect budget, that is, one in which important items were not represented, would be worse than no budget at all, for the reason that it might beget an unjustifiable confidence.

**39. Example of Budget.**—The general form in which a budget may be constructed is illustrated in Fig. 5. Although only part of the budget is given, the principle on which it has been made up will be clearly enough understood. The factory naturally has first place, since in most manufacturing businesses it will be responsible for the larger portion of the expenditure. It will be seen, on reference to the chart, that the main divisions of factory expenditure are given, followed in many cases by a more detailed analysis of the listed item. Thus, the pay roll, one of the most important avenues of outgoing cash, is divided, first, into productive and non-productive wages. Then the latter item is subdivided again into its main components, namely: superintendence, which will include wages of foremen and overseers; general labor, such as cleaners, helpers, crane hands, and so forth; clerical help, including time keep-

ers, watchmen, and caretakers; repairs, which represents the wages of any workers, whether normally belonging to the productive staff or not, who are engaged in maintenance and repair work. Finally, the wages lost on work that has been rejected by inspectors is listed under the head of *spoiled work*. It will be unnecessary to go over the remaining headings, as they will be easily understood from an inspection of the chart. Each plant will have to compile its own list of items. The way in which the items enumerated are filled out, and the use that is made of the figures, must now be considered.

**40. Compiling Budget.**—Let it be supposed that, to begin with, a list has been prepared corresponding to that shown in Fig. 5, but filled out with the actual figures of the previous year. Budgeting may then commence. It will be remembered that what is required is a forecast. Therefore, most of the figures to be inserted in the *Expected* columns will probably be different from those given in last year's accounts. The first thing is to make a reasonable forecast of the course of business in the coming year, having in view the growth in the past, and what may be known as to the general prospects of trade. If, after considering these points most carefully, it is decided that no increase of business may be expected, then last year's figures will probably be sufficient. But, if either an increase or decrease is expected, then the probable amount of such change should be estimated. Having decided on this, it is necessary to go over the budget headings, one by one, and ask, in each case, how the increase or decrease is going to affect each item. Some, such as productive wages, will probably be affected considerably, others, such as superintendence, very little. The possibility of reducing some items, such as general labor, or clerical help, should be discussed, if a period of depressed trade is expected. If an increase seems likely, then the amount to be allotted to these items must be increased, on a basis of past experience.

**41. Distribution of Increase or Decrease.**—It is evident that when all the items of the budget have been gone over in the way indicated, a figure representing total expenditure is

obtained, that corresponds to the expected ratio of increase or decrease. It must not be forgotten that the result of the budget is not a figure that is a mere multiple of last year's figures. Thus, on the assumption that an increase of 25 per cent. in business may be reasonably expected, the resulting figures will not be simply last year's figures increased by one-quarter. If that were so, the budget would hardly be worth the trouble spent on its compilation. The important point to observe is that the influence of a 25 per cent. increase in business on each separate item of expenditure has been reviewed in preparing the budget. Its effect on each item will be quite individual. This is a wholly different matter from simply increasing the total budget by one-quarter. The effect on the total budget may be more or much less than this, according as the existing organization is equipped to handle more business without much extra expense or not. In compiling the budget, each month is considered separately. This may be more important in some businesses than in others. Where seasonal trade is done it is all-important; where a uniform trade throughout the year is done it is less important to lay out each month separately; but it is always safer to do so. When completed the budget will display the full details of expected expenditure for each item, month by month throughout the year. The budget is then ready for use.

42. **Use of Budget.**—The budget, with its *Expected* columns filled out in detail for each month, has now to be applied to practical use by the executive. As soon after the end of each month as possible the accountant will insert against each item the actual expenditure on that item, as recorded by his books. This figure will be inserted in column headed *Actual*. It will be well to establish a convention that a small variation from the expected figures, say up to 10 per cent., shall be inserted in black ink, while if the variation is more than 10 per cent., or whatever percentage is fixed by the executive, it shall be written, if an increase, in green ink; and if a decrease, in red ink. A glance at the *Actual* column will show how expectation is being fulfilled. A general area of black entries

means that expectation is being realized. Much red ink will suggest that a general tendency towards lower figures exists, while much green ink will show that expenditure is generally higher than was expected. In either case further investigation will be necessary. It will be observed that what the budget does is to establish, for each class and each item of expenditure, a datum, any serious departure from which attracts immediate attention. No other method of controlling expenditure is so searching as this. The executive that has established an exhaustive and carefully worked out budgeting system can be assured that nothing will get very far away from control, without being brought under the searchlight of further investigation.

43. **Returns or Income.**—As the sources of income are very few in comparison with the avenues of expenditure, no very great elaboration is necessary to provide for a forecast of returns. A forecast of sales is made in the same manner as that described for expenditure; in fact, the latter forecast is necessarily based on the expectation of sales. The sales budget will vary in complexity according as one or many lines of goods are manufactured; if only one, then a chart, such as that shown in Fig. 6, will serve to record the expected and

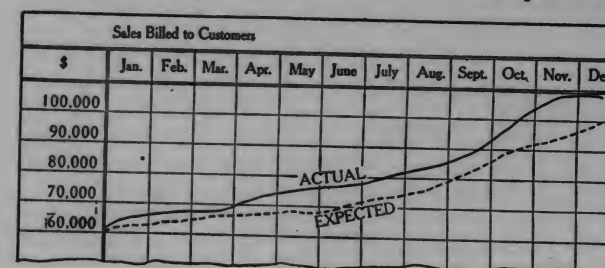


FIG. 6

actual conditions. This chart is *cumulative*; that is, the curve represents results to date at any month's end. Thus the first month's figures represent the sales of that month. February figures represent January plus February, and so on. On the



same chart with the expected, the actual sales are plotted in the same manner. It will be seen in the example given in the illustration that the actual business has been ahead of the expected throughout the year. A chart of this character is not, however, read for past history. Its use is to allow the executive to observe, at the end of the current month, just how sales are behaving in comparison with the expectation that was formed of them.

**44. More Detailed Sales Budgets.**—Where several lines of product are being manufactured, the forecast may be carried out in greater detail. Separate charts may be set up for each line of goods, especially where variation in the demand in different lines results in varying strain upon factory efforts. Where this is the case, the sales budget should be constructed in as detailed form as possible, since the forecast, when made, will have important bearing on the detail of the expenditure budget. If for any reason the demand for one line of product is likely to fall off, or on the contrary to increase greatly, this must be allowed for in establishing the factory budget, in case the product in question requires very different treatment in the factory from other products. Though the total of sales might be expected to be similar to last year's, it would in this case be necessary, in constructing the factory budget, to make allowance for the individual character of the product. In other ways the budget system may be applied to forecasting sales activities, namely, by extending the analysis to sales districts or travelers' routes. This, however, has little to do with finance, which is concerned only with the total income from each class of goods. The further analysis just spoken of is really the quota system already discussed.

**45. Collections.**—In order to succeed in business it is not only necessary to make sales; it is equally essential to collect the proceeds. In businesses of any considerable size this task is entrusted to a special department of credits and collections. The executive, however, will need to keep in close touch with the general situation. One means of doing this is illustrated in Fig. 7. The curve in this diagram is cumulative, so that at the

end of the year its high point shows the total sales of the whole year. Each month the total actual sales to date are plotted. Alongside the curve of sales is plotted another cumulative curve, in ink of a different color, which represents actual collections. The relation of these two curves to each other will

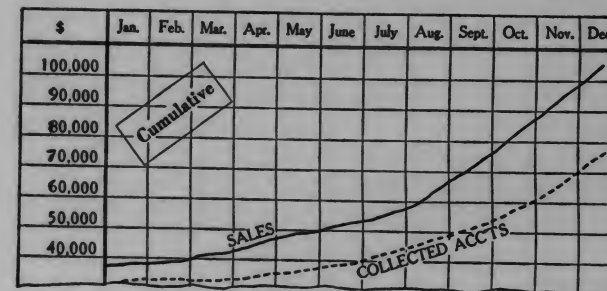


FIG. 7

disclose how satisfactorily collections are proceeding. If a widening gap appears between the lines, with the sales curve on top, this signifies that collections are falling behind. If, on the contrary, the gap is narrowing, or if collections pass above sales, it signifies that collections are very close up. It is very rarely that collections can get above sales, because this would imply that all, or nearly all, customers' accounts were paid up, a condition not likely to occur under ordinary circumstances. In general the two curves will run parallel and close to each other. In the illustration shown, collections are falling behind.

**46. Analysis of Collectibles.**—In addition to the curve shown in Fig. 7, the executive should observe how the collections, as reported, are made up. It might happen, for example, that a large collection total was shown, but that this was made up of fairly recent accounts, leaving older accounts uncollected. The chart shown in Fig. 8 will enable the executive to observe just how far customers are being allowed to get behind. The chart is made up of three divisions, each providing for a year's record. Each division is devoted to a different class of col-

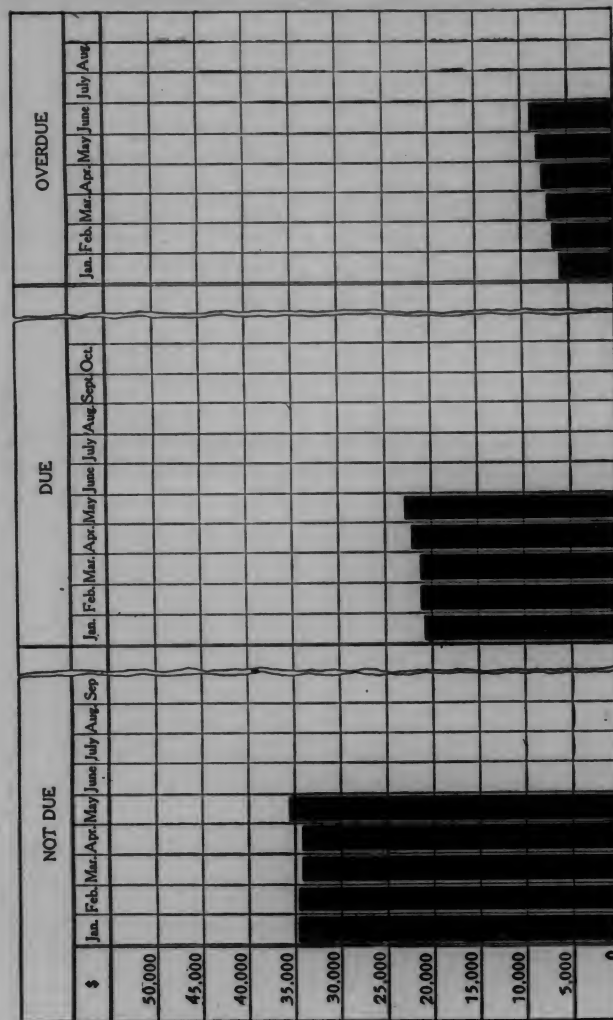


FIG. 8

lectible accounts. In the first division is charted the total of all accounts invoiced during the month, and therefore not yet due, added to such accounts as are a basis of longer credit and were invoiced in previous months. All accounts not yet due, whatever the reason, are charted in this division. Next, the total of accounts due and unpaid at the end of the month is shown in the second division. In the third division is charted the total of all accounts that are overdue. This latter class may be subdivided if desired. Thus one division may be for accounts thirty days in arrear, another for accounts sixty days overdue, and so forth. A glance at this chart is sufficient to show the executive just how his collection department is working. In the illustration it will be noticed that overdue accounts are steadily on the increase.

**47. Committals.**—The two charts last described show the way in which incoming cash is behaving. There must also

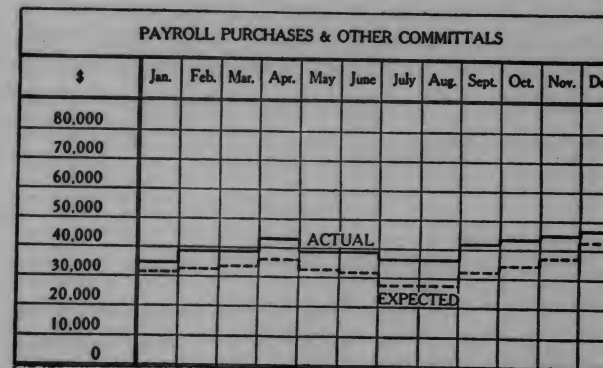


FIG. 9

be considered the outgoing cash. The budget will provide a monthly total of expected cash requirements, for expenditures and committals. (A committal is an incurred liability, such as a purchase, for which cash has to be paid within a short time.) The monthly total from the budget is then charted as shown in Fig. 9. The dotted line in the drawing represents

expected committals. In practice a colored line would be used. Then at the end of each month the actual cash outgoings are plotted on the same chart. These are represented in the chart by the black line. It will be seen that actual expenditure has been ahead of expected committals all through the year. As drawn the curve is non-cumulative, but it may be instructive to accompany this chart with a similar one in which the curves are cumulative. Such a chart will show at the end of each month, how far total actual expenditure and committals differ from total expected expenditure up to date. It must not be forgotten, however, that the budget does not include such expenditures of cash as will merely increase inventories. Should, for example, a large purchase of material be made in order to take advantage of market conditions, or should new machinery be purchased, this would not be represented in the budget nor in the dotted line on the chart. It would on the contrary appear in the solid line. The reading of the chart is absolute as regards actual conditions, but inaccurate forecasting must not hastily be inferred. A discrepancy would, however, point the way to inquiry, and this is the real object of the chart.

**48. Cash Movements In and Out.**—The method of watching incoming cash on the one hand and outgoing cash

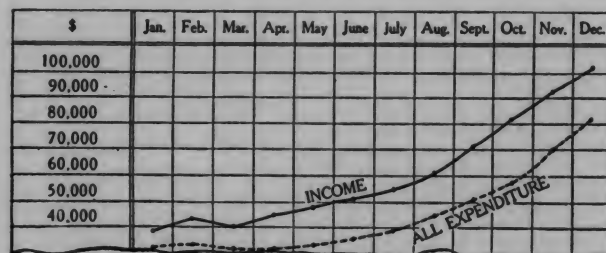


FIG. 10

on the other has now been discussed. It is desirable also for the executive to have a picture before him of the relation of these two streams of cash to each other. In the chart, Fig.

10, which is cumulative, this picture is supplied. In practice, lines of different color would be employed. Collections to date are plotted in one curve and actual expenditure to date in another. The difference between the two curves is not profit, as might hastily be assumed. The solid line represents not sales, but merely sales for which the money has been collected. Even if actual sales were plotted against expenditure, the gap would not necessarily represent profit. This would be true only if inventories and liabilities were maintained at a steady value. If inventories, say stores, or work-in-process, rise or fall, the gap would represent nothing significant. The object of the curve is to provide the executive with a swift summary of the relation of income to expenditure. The chart, as with others of similar character, is intended to be read, not as history, but as a guide to action at the end of each month. A rise in the proportion of expenditure to income, or what amounts to the same thing, conversely, a fall in the proportion of income to expenditure, will be instantly read from the chart, and should serve as a danger signal, calling for immediate attention and investigation of its meaning.

**49. Bank Balance.**—Incoming cash flows into, and outgoing cash flows out from the bank balance, just as water flows into and out of a reservoir. And similarly, the bank

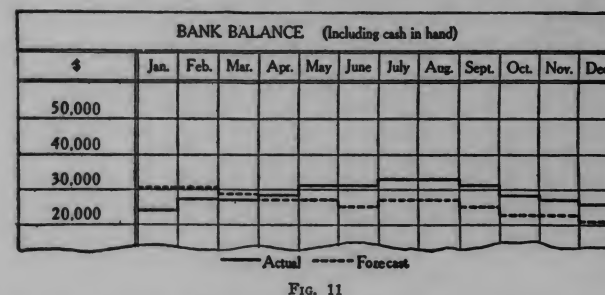


FIG. 11

balance will rise and fall just as the level of the water rises and falls, according as the incoming or outgoing stream is for the moment the heavier. A large bank balance is a relatively

unprofitable thing, just as a large value in hand of materials or other slowly moving goods is relatively unprofitable. The sign of good management is a condition in which the minimum of capital is lying idle. One of the objects sought by the method of budgeting and the other devices described in these articles, is to enable the executive to plan his arrangements in such a way as to keep inventories of all kinds, including overdue accounts and bank balances, at a minimum. Of the two evils it is of course far better to have capital in the form of a bank balance rather than locked up in slowly moving materials or slowly moving accounts. All these matters depend on the judgment of the executive and no rules can be given. All that can be done is to describe the various devices by which he may keep in intimate touch with facts. In Fig. 11 is shown a chart representing, each month, the rise or fall of the cash resources. It includes both cash in hand and bank balance. The curve is non-cumulative. As in the case of expenditure, it is useful, when forecasting the coming year, to include a forecast of the cash resources each month, based on previous records and future probabilities. The chart shows at a glance how expectations are being realized. Increasing discrepancy would suggest inquiry.

**50. Profit and Loss.**—In discussing Fig. 10, it was mentioned that a chart of collections and expenditures could hardly ever represent actual profit. In other words, there is no simple and chartable relation between income, expenditure, and profit. Even if incoming cash were analyzed into two parts, the one to cover cost, the other gross profit, it would not be possible to say whether this gross profit was a distributable one. It might be found, when all was reckoned, that part of this gross profit had already been absorbed in purchases of materials or other property. Also, the arithmetical statement of profit is not necessarily the true statement, for it is subject to deductions through the Profit and Loss account, or as it is sometimes termed, the Loss and Gain account. Thus, it may be found that certain assets have diminished in value, since the last balance sheet, for various

reasons. A line of goods in stock may have become unsalable at the expected price; goods may have been damaged by accident; certain machines may have been withdrawn and replaced by better ones. In all such cases, the arithmetical value, that is the value shown in the accounts, must be reduced to represent the new value, if any. This process is called *writing off* a loss. The account to be reduced, say Stores, is credited, and Profit and Loss account charged, with the amount it is desired to write off.

**51. Adjustments.**—The Profit and Loss account is the adjustment account. It is the account that requires the special attention of the executive. It is here that the gross profit from trading meets other items of income, such as that from investments or rentals, so as to assemble the total income. Here also are brought together all the expenditures that are not borne by trading, such as cost of lawsuits, extensive losses by fire, etc. Where depreciation is not charged into costs, as it always should be, it is charged off in this account. When all items of income have been assembled and all deductions made, the balance will be surplus, or if unfavorable, loss. The items of a Profit and Loss account are as capable of being forecast as any other future transactions. A blank similar to Fig. 5 may be set up, the wording being changed so as to represent all the debit and credit items that enter into the account. Then the expected and actual figures may be placed side by side each month. While a trading account may be made up so as to indicate, separately, the gross profit made on each class of goods sold, the Profit and Loss account is purely financial. It is one of the two official documents that go to stockholders, the other being the balance sheet. It is not usual therefore to include in the Profit and Loss account more than such totals as will throw but little light on the internal working of the business.

**52. Balance Sheet.**—A good deal about the principles underlying the compilation of balance sheets will have been gathered from earlier articles. It will only be necessary here to give examples of various devices by which the exec-



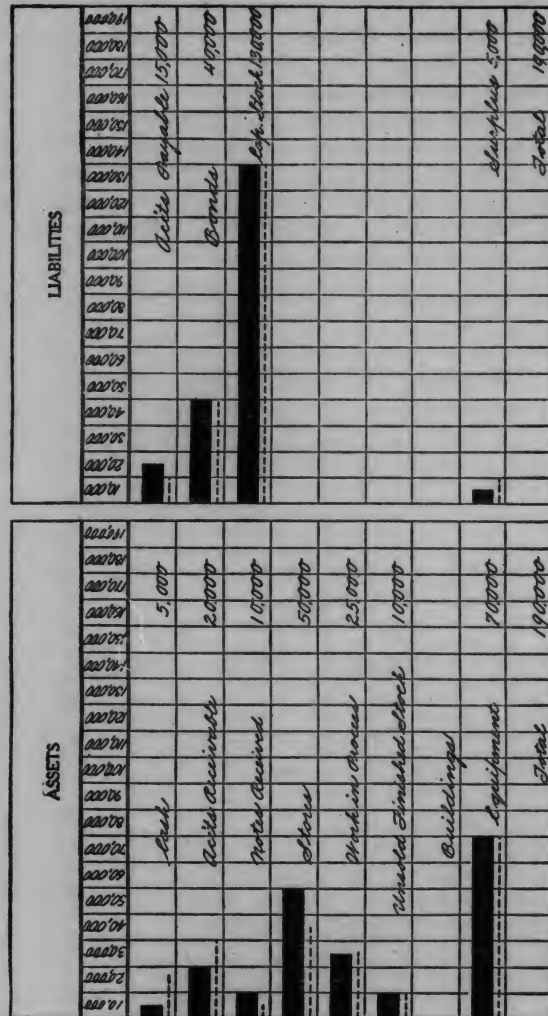


FIG. 12

utive can picture the changes in assets that have taken place during the period covered by the balance sheet. The official balance sheet, like the official Profit and Loss account, rarely contains more than the barest totals, sufficient to indicate the broad nature of assets. For the executive's own use, however, greater subdivision may be useful, and a method of arranging this will be described. The first to be considered is the ordinary type of balance sheet. A graphic method of representing this is shown in Fig. 12. The chart illustrated serves not only to record current events, but also to establish comparison with the forecast or expected conditions. Assets are shown both in actual figures, and also graphically, being represented by the black bars, the lengths of which are proportional to the value of the several items, as indicated by the headings of the vertical columns. The relative value of each kind of property and of each kind of liability thus immediately catches the eye.

A single example, such as that shown in Fig. 12, conveys no very significant message, but if it is considered as forming part of a series of such sheets prepared consecutively as time goes on, comparison is easy and does become very significant. Moreover, by looking at the dotted lines (which in practice would be colored bars) the executive can observe the degree to which actual performance has corresponded with the figures expected or forecast. It will be noted that in the illustration, assets are less liquid than was expected, and liabilities greater.

**53. Comparative Balance Sheets.**—For executive use the balance sheet may, as mentioned in the preceding article, be compiled in greater detail. Advantage can also be taken of the opportunity to provide for detailed comparison with a forecast made on the lines of a budget. Budgeting, in fact, should always involve the forecasting of the year's transactions in all aspects; otherwise, there is little check on the accuracy of the forecast. Figures that have been forecast need to be brought to proof just as much as actual figures. In Fig. 13 a comparative progressive balance sheet is illustrated. It will be noticed, by comparing with Fig. 12, that much

ASSETS	January		February	
	Expected	Actual	Expected	Actual
<b>1 CASH</b>				
Cash in Hand				
Cash at Bank				
<b>2 COLLECTIBLE ACCOUNTS</b>				
Not Due				
Due				
Overdue: A				
B				
C				
<b>3 STORES</b>				
Productive Mat'l				
Non-productive				
<b>3 WORK IN PROCESS</b>				
Productive				
Non-productive				
Add'n to Value				
<b>4 FINISHED GOODS</b>				
Class A				
Class B				
<b>5 EQUIPMENT</b>				
Productive				
Power Plant				
Sundry Factory				
Office Equip't				
Buildings				
<b>LIABILITIES</b>				
<b>1 ACCOUNTS PAYABLE</b>				
Not Due				
Due				
Overdue				
<b>2 CAPITAL STOCK</b>				
<b>3 SURPLUS</b>				

FIG. 13

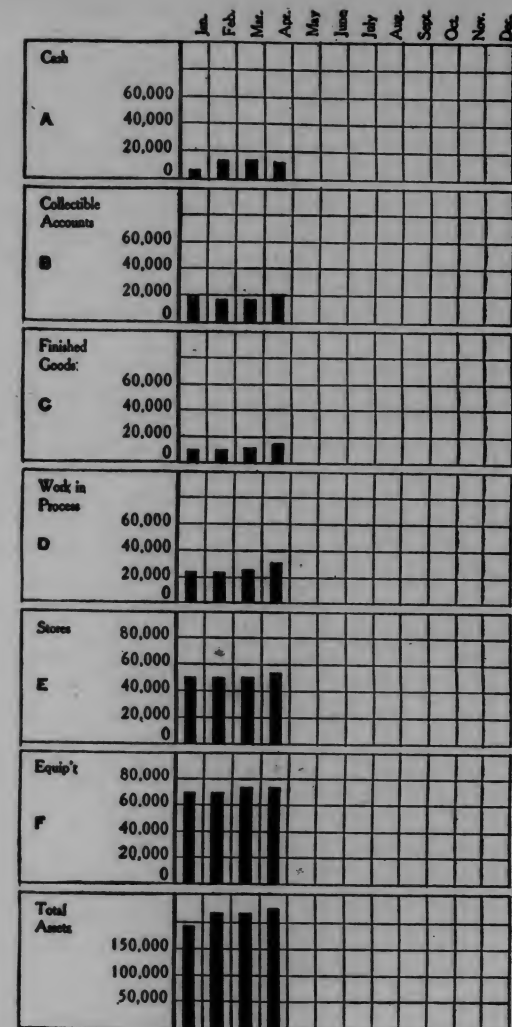


FIG. 14

greater detail is supplied. Inspection of Fig. 13 will render a description unnecessary. The item Collectible Accounts, with its subdivisions *A, B, C*, may, however, be explained. These represent a classification according to the length of time overdue, say thirty, sixty, and ninety days, respectively. Finished Goods may be similarly classified, as shown by *A, B*, in the illustration. The actual figures are placed alongside the expected figures just as in the ordinary budget. A very complete control over the changes of the value of assets, and over liabilities, is thus obtained by the executive.

**54. Visualizing Assets.**—A balance sheet like that shown in Fig. 13 can be visualized to some extent by means of separate charts, one for each item, as represented in Fig. 14, which shows, however, assets alone. A similar arrangement would be adopted to show liabilities. In the illustration only actual (not forecast) figures are represented, but columns could be arranged in pairs for each month, one column being marked up in red for expected figures and the other in black for actual figures. Some precautions are advisable. The charts should be much larger in scale than shown, and all of them, including the totals charts, should be drawn to the same scale. It is perhaps inadvisable to attempt to chart the subdivisions of the main items as given in Fig. 13. Too much detail prevents the quick reading of charts, and therefore diminishes their usefulness. If made to an adequate scale, with actual and expected figures in different colors, such charts are found very useful.

#### EXERCISES

- (1) Explain how, with a good surplus at the end of the year, a firm may nevertheless find itself in serious financial difficulties.
- (2) Distinguish between expenditure and expense. Illustrate the distinction by means of examples.
- (3) The business transacted by a firm has increased by 30 per cent. from the previous year. Discuss the effect of this increase on the running expenditure, indicating what circumstances will determine whether these expenditures will increase in the same, in greater, or in less proportion than the total business transacted.

- (4) (a) What is meant by *depreciation rate*? (b) What bearing has it on the compiling of the balance sheet?
- (5) A person has \$100,000 left to him by will. He invests this money by erecting a factory and conducting a business in his own name. On the balance sheet the capital invested appears on the liabilities side. Why?
- (6) Under what circumstances is an undistributable surplus commercially justifiable?
- (7) What is meant by *unseen assets*? Give examples.
- (8) (a) Give examples of changes in business conditions that ought to be covered and duly provided for by the forecast on which a budget is based. (b) Give examples of conditions that may affect the business situation, and against which the budget cannot furnish protection.
- (9) (a) Explain how an arithmetically correct balance sheet may nevertheless give a very false impression of the financial standing of a business establishment. (b) Indicate how the executive is responsible for the reliability of the balance sheet as a true gauge of the financial status of the business in his charge.
- (10) What is the difference between an undistributable surplus and an unrealizable surplus?

## CHAPTER X

### RECONSTRUCTION, BETTERMENT. AND PLANNING

#### MATTERS OUTSIDE ROUTINE

1. **Routine and Policy.**—Most of the matters that have been discussed in the foregoing Sections have related to the current routine of business operations. Business is made up of such a multitude of details that mere routine operation is apt to take all the attention of the executive. To conduct a business successfully demands unremitting attention to what is actually happening. The position of the executive is very much like that of the captain of a ship, who is responsible for its working from hour to hour, and is also responsible for its safe arrival in port. If a satisfactory balance sheet is regarded as the equivalent of the ship's arrival in port, the parallel is very close. But it may be observed that, under ordinary circumstances, the captain's responsibility is confined within the limits stated. The actual destination of the ship, so long as it is clearly laid down in his instructions, does not concern him. The purpose of the voyage is not his affair. He does not have to lie awake nights worrying whether the voyage was a judicious one to make, or whether some other port would have served the turn of the owners to better effect. In other words, routine operation is all he has to think about, and he does not have to consider questions of policy.

2. **Position of Executive.**—The position of an executive in a business of any considerable importance is such that he is responsible for the success of routine operations, and for much more. It is true that in quieter times the executive did not have to trouble himself greatly beyond effective supervision of routine. When competition was mild and businesses grew by slow natural increase, changes necessary were few and relatively unimportant. There was always time to take care of them, and if they were introduced slowly they produced little disturbance in the regular course of business. Competitors were in all probability acting in the same deliberate manner. The monster aggressive advertising campaign to force business was unknown. For the most part, therefore, the executive was justified in letting the future take care of itself, secure in the reflection that whenever progress became necessary the fact would force itself on his attention in sufficient time for a cautious and deliberate survey of all the circumstances. Such a thing as systematic prosecution of development plans was unknown, except perhaps to a very few exceptional men, who thereby became great industrial powers, no one knew exactly how or why.

3. **Modern Competition.**—It will be evident that the picture just given of the old-time executive is very far from applying to his representative of the present day. Competition is not only keener, but far more rapid in its action. One reason of this is that it is no longer necessary slowly to evolve a staff organization. Expert advice can be readily obtained on almost every phase of business activity, so that effective competition is no longer a question of years of growth. It can spring up almost overnight. Even in a case in which such competition ultimately fails, its disturbing effect is apt to be extremely serious. Furthermore, the chance of success of a competitor will be in proportion as the established firms that have to meet his attack are caught unprepared. When, therefore, it is claimed that the modern executive must look to the future as well as to the present, it is no mere platitude that is offered. It is a vital truth that cannot be evaded without the



greatest peril. The executive must, by making use of the methods of control that have been described in the foregoing Sections, reduce his participation in routine to just the minimum necessary to keep and exercise effective supervision, and must keep himself free to give a large share of his attention to the future development of his business.

**4. Progressive Outlook.**—While a large volume could be written on the duties of the executive in looking toward the future, it will be possible here only to glance briefly at some of the more important directions in which foresight must be exercised. Such foresight cannot be confined to improvement in the operative efficiency of the plant alone. That is only what might be termed the interior view of the matter. It is equally important to observe the activity of competitors and to consider the value of methods they may be using in manufacturing, management, or sales operations. Nor is this all. Important hints may be gathered from methods and devices used in other industries. A great deal of progress consists in the transfer to one industry of methods found valuable in quite dissimilar industries, suitable changes being made to adapt such methods to their new uses. Again, there is the whole field of technical progress to consider. Nearly all industry today has a scientific aspect if not a scientific basis. Few manufacturing operations are independent of technical considerations as to the properties of raw material or of supplies of some sort used in productive processes. Many industries, also, are developed by persistent search for new uses for their product. These are some of the principal matters that will be briefly considered in the following articles.

#### TECHNICAL BETTERMENT

**5. Technical Aspect of Production.**—Technical betterment relates to the scientific and technical principles underlying all kinds of production. The technical side of production is that which has to do with sources, qualities and selection of raw material, its behavior under process, and the properties

possessed by the finished product. It is well understood that some industries are more highly technical than others; the number and the importance of the scientific and technical questions arising in the course of operations vary from industry to industry. Hardly any industry is, however, free from such technical questions. The manufacture, for example, of the incandescent or glow lamp, is a highly scientific industry, and is an excellent example of what continuous technical betterment can do. But even in a comparatively simple industry,

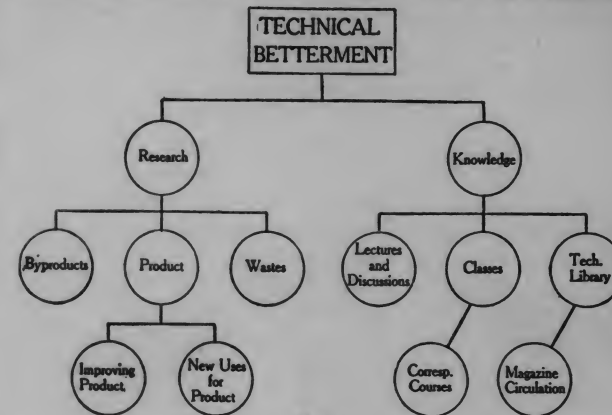


FIG. 1

such as a metal foundry, for example, only thorough understanding and control of the composition and reaction of materials can give any high measure of success. For practical purposes technical betterment may be considered under two aspects, the one connected with research, that is, investigation, experiment, and discovery, and the other concerned with the collection and dissemination of technical knowledge among the staff and the employees. Each of these aspects will be discussed in some detail. The diagram, Fig. 1, shows the range of the discussion.

**6. Information Service.**—As research is itself dependent on a previous and very extensive accumulation of technical

knowledge, it will be well to consider this first. The first thing to be done in setting up a research organization is to collect systematically all information that can be gathered on the subject of the materials and processes entering into product. The possible sources of such information are many. The proceedings of scientific and technical societies, of trade conventions, and of government bureaus, should be systematically combed and the information found should be copied, classified and indexed. All the more important books relating to the subject should be purchased and examined, any contents having direct and important bearing on the work being carefully indexed. The technical and trade magazines will form another quarry that must be carefully and systematically worked. The search should not be confined to home sources, but should include foreign publications, notably those in England, France, and Germany. When necessary, translations should be made of important papers. All this involves some expense, but in a plant of any considerable size such expense fully justifies itself. A few ideas, even minor ones, discovered and applied each year, will amply repay the cost. Moreover, the satisfaction of knowing that nothing involving the improvement of the product or the welfare of the industry can happen without being noticed should be a matter of satisfaction to the progressive executive.

**7. Technical Library.**—The information service, drawing on all the sources mentioned in the preceding article, should be centered in a special room, known as a technical library. This should be in charge of a competent man, who is versed in the technicalities of the business and is therefore able to exercise discrimination in filling his files. A working knowledge of French and German will be of advantage to him on account of the large amount of valuable matter that is published in one or other of those languages. In some lines of work a reading knowledge, at least, of these languages may be wholly indispensable. The position may be held very satisfactorily by a man who has in the past filled responsible positions, but who on account of advancing age or ill health is unable to take

charge of strenuous routine work. What is chiefly wanted is mature experience. The library should be provided with convenient files, bookshelves, and a very complete indexing system, since the value of the department will depend on the ability to find information rapidly and surely when it is wanted. An indexing code, similar to the Dewey library code, should be devised to cover the needs of the special industry, so that every item shall find its natural filing division. It is understood that the library should not confine itself to filing information bearing on the product alone. All matters that suggest possible betterment in any direction will receive attention; that is to say, the information to be filed will cover nearly all the points discussed in this Section.

**8. Circulating Information.**—To make the resources of the library effective, it is not enough to file and index alone. The arrival of important matter must be signalled to persons throughout the plant who are likely to be interested. This may be done in various ways. An obvious expedient commonly adopted is to attach to the cover of a magazine or book a slip with a list of the officials whose attention is invited. The magazine is then circulated from one to another of these, each man initialing the slip as he passes the magazine to the next man on the list. Where a more extensive system, involving all branches of information, is organized, it may be well for the librarian to compile, each week, a bulletin enumerating the various items of information that have been placed on file during the week. This should be manifolded on a duplicator and furnished to all members of the staff. To encourage the study of technical matters among the employes, such bulletins should be published by being posted up or included in the plant magazine if there is one, as soon as the current demand on the part of the staff has ceased. If the information gathered is thrown open to the employes a month after receipt, the convenience of all parties will have been met. At the end of a year, all the bulletins should be consolidated and reduced to a single well-classified index. This should then be printed and circulated to all the staff, since the essential function of a technical

library is to facilitate ready reference to all its resources. Information not readily accessible falls to the value of waste paper.

**9. Classes and Courses.**—Technical training for everyone should be the aim of the progressive executive. At least, the opportunity should be provided, even though there will always be many who will not take advantage of it. The object to be attained is not, perhaps, so much to train the rank and file as to discover talent. In every large group of men there will be a few who have the makings of better things in them. Such persons, however, unless opportunity is presented to them, are liable to remain undeveloped and unaware of their own powers. The executive should therefore promote a system of technical training, wherever possible. This may be done by organizing classes in charge of competent instructors. The classes will usually be held after hours, but where it is especially desirable to find material for promotion, or where other special reasons exist, the classes may be held during regular work hours. This is more frequently done in the case of apprentices than of paid workers. Another way of proceeding is to encourage the employes to enter a correspondence course. Arrangements may be made to keep in touch with the progress of candidates, and the executive may offer some prize or distinction as a reward for completion of the course. It may be feasible sometimes to have an examination at the end of the course and award a prize or prizes to the most successful candidates.

**10. Lectures and Discussions.**—The possibilities of the lecture, especially when illustrated by stereopticon views or moving pictures, are little appreciated, it might be said are ignored, by the average executive. In large plants, especially those of the engineering type, a technical society is sometimes organized among the staff and employes. Such a society provides excellent opportunity for self-development. Not only do the members prepare and read papers on the difficulties of the daily routine, which very often give rise to illuminating discussion, but opportunity is given to hear prominent technical

men who will often accept invitations to address such societies. Where a development of this kind is impracticable, a partial substitute may be provided by a series of lectures, carefully planned, and well illustrated with interesting exhibits or pictures. One thing that can be accomplished by this means is to interest the employes in the product and its story. Some firms take moving pictures of their shops and accompany them by a talk explanatory of the way in which the different steps of the process dovetail together. In other cases a good deal may be said about the distribution of the product, especially if it finds its way into foreign countries or in unfamiliar surroundings. Anything that will promote interest of the employes in the firm and its work is worth undertaking. The influence of such efforts cannot be measured by their cost.

**11. Two Kinds of Research.**—All successful research is based on exhaustive knowledge of what has already been accomplished in the field; for, in the absence of such knowledge, time spent on research would for the most part be wasted in merely rediscovering facts previously ascertained by others. The method that may be followed to accumulate and disseminate knowledge of what has already been done or is in progress in the hands of other investigators has been described in preceding articles. It is now in order to consider what particular direction research should take to be successful and profitable. There are two kinds of research, each of which yields most valuable results, but only one of which is commonly applicable directly to the needs of an industrial plant. The first type of research consists in the exploration of phenomena simply for the gain of knowledge itself, without any immediate thought of practical application (although history has amply shown that such application nearly always follows in the train of new discoveries of any kind). Research of this first kind may consist, for example, in the study of the behavior of X-rays in passing through a crystal; or of the chemical character of white of egg (albumen); or of anything at all that may happen to be of human interest for any reason whatsoever, aside from the definite purpose or expectation of applying the results to

practical, gainful ends. Research of this kind is commonly spoken of as research in pure science.

The second type of research is definitely directed toward the solution of some specific practical problem. So, for example, the use of X-rays might be developed in the examination of a product for hidden flaws; or, the chemical character of a group of substances may be investigated in relation to their action on the human body and with a view to developing new drugs. Industrial research is mostly of the second type, or research in applied science. It is devoted to the solution of specific problems that present themselves in the course of manufacturing.

**12. Three Aims of Industrial Research.**—Industrial research is directed: first, to improvements in materials or processing of product; second, to examining and working up byproducts; third, to the utilization of wastes. The field for research is almost unlimited, though, naturally, in some industries, there are neither byproducts nor wastes to be considered. Yet in all but the simplest industries the possibilities of technical progress are great and its value limitless. "The older I get, the less I seem to know about steel", said the head of a well-known steel making plant. This illustrates the point that every advance made in technical efficiency opens wide the door to new advances. The task is never complete. As for the opportunities that present themselves in the recovery of wastes, these are well illustrated by the remark of the present owner of an old-established soap plant: "My father and my grandfather must have run into the sewers a value equal to the whole capitalization of the plant." The strong position that Germany had built up for itself in the dye industry, before the war, was earned very largely as the reward of an unremitting and extensive research campaign continued through half a century.

**13. Research in Relation to Product.**—The most natural starting point for technical research is to attack the problem presented by some existing difficulty. Imperfection in product, for example, naturally suggests a study of the

causes. When complaints are being received, the search for a remedy is too obviously called for to need comment. But research can be applied in other directions. One of its principal aims is toward greater economy in production. It may happen that a given material may be suitable, but that it is difficult to machine; or, a process may yield good results, but be involved or costly. In either case research will sometimes hit on a substitute material equally suitable but free from objections. Sometimes such a substitute may be sought mainly on the ground of cheapness, or it may happen that special conditions to which part of the product is subjected—for example, exposure to the damp heat of tropical countries—renders it advisable to use other material, or perhaps, to give the regular material some special treatment to enable it to stand up under the stated conditions. Economy in production, a better article, an article adapted to some special condition, the elimination of costly and tedious processes—all these are matters in which systematic research can give powerful aid.

**14. New Uses for Product.**—While the scientific selection of materials, and a careful study of the changes they go through will do much to perfect the product and increase economy in manufacture, research may also be directed to the discovery of new uses for the product. Such uses may depend on the utilization of some quality of the product not yet generally known or recognized. Some products, such as vulcanized rubber and its derivatives, are in themselves of the nature of raw material for other industries. In other cases it may be a special alloy that is being manufactured, and for which many new uses may be found by research. Or again, it may be a device or machine that is under investigation. A polishing machine, for example, made for one material and one industry, may be found adaptable to another material and a wholly different industry, thus greatly extending its market. Plants making stampings or die castings would do well to be continually on the watch for opportunities to substitute their product for other and more costly metal forms. For such work an almost unlimited field exists. Except in the case of common



staple articles, there are very few plants that would not benefit by giving attention to the research for new uses.

**15. By-Products and Wastes.**—It is sometimes difficult to draw the line between wastes and byproducts. It has been said that a waste is a byproduct that has not yet been put to use. If a distinction must be drawn, it might be said, in general, that byproducts are more or less useful materials resulting unavoidably (that is, apart from purpose or design), in the course of the manufacture of the main product, the making of which is the actual purpose of operations. For example, in the manufacture of soap, fats (such as beef suet and mutton tallow) are boiled with alkali to produce the soap. But along with the soap there is unavoidably produced glycerine, which, though not a material originally aimed at, is nevertheless valuable, and therefore collected and marketed as a byproduct.

Wastes, on the other hand, are scraps and residues of seemingly little or no value, such as inevitably occur in the making of the product. Such waste may consist of parings, shavings, filings, etc., of material from which articles are made; or it may take the form of muds, slimes, residues, filter cakes, etc., such as occur in the chemical and metallurgical treatment of various solutions. Inasmuch as a use may at any time be found for a seemingly useless waste, or market conditions may so change as to give it a value, it is evident that a waste may at any time pass into a useful byproduct, so that the line dividing these two classes of products can never be narrowly drawn.

In many industries a great field exists for prolonged and close research on the utilization of wastes and byproducts. In the cement industry, for example, the waste gases were laden with dust that was an annoyance to the surrounding district. Research was undertaken to find a method of removing this dust and preventing its escape into the atmosphere. The result was unexpected. Curiosity having led to an analysis of the recovered deposit, this was found to consist largely of potash. During the war some plants made as much money out of the waste thus caught and suitably transformed into marketable

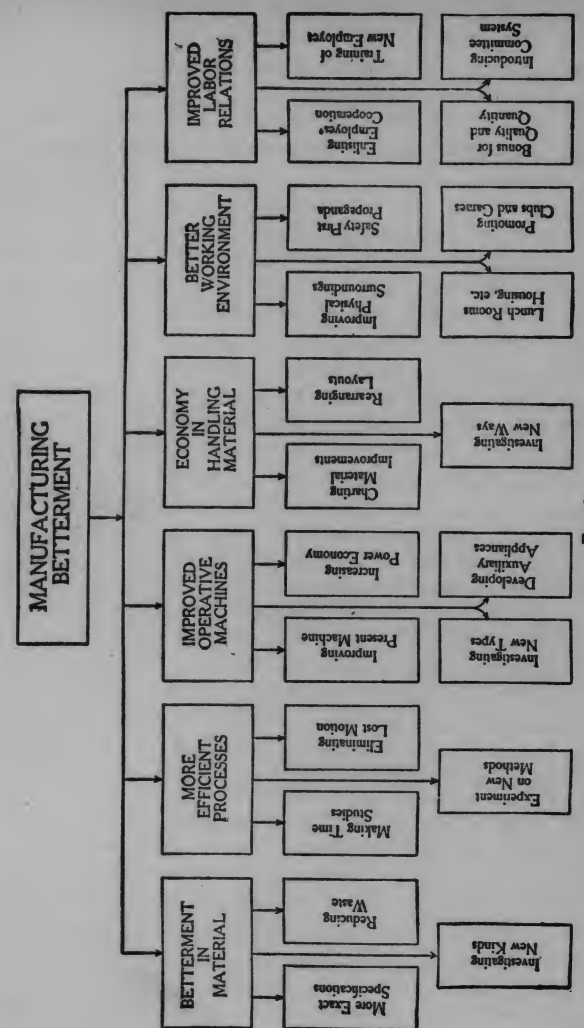


FIG. 2

product, as out of the regular business of the plant. Examples could be multiplied, but enough has been said to draw attention to the place of research in furthering the interest of any manufacturer who is sufficiently wide awake to see the advantages to be gained.

### MANUFACTURING BETTERMENT

#### THE MATERIAL ELEMENT

**16. Range of Discussion.**—Technical betterment is usually a laboratory undertaking; at any rate, it depends on an intimate technical study of materials and processes peculiar to the industry. Under the heading of manufacturing betterment will be discussed matters of more general character, equally important to the continued progress of the plant. The subjects of study will still be material and product, but the product will, as it were, be taken for granted; that is to say, it will be assumed that the product is in every way satisfactory. Attention will now be turned to the manufacturing process itself, and the subject of inquiry will be: Is the manufacture conducted in such a manner as to produce the best results? The discussion must cover material, processes, operative machinery, handling, and the development of better working conditions for labor and closer relations between labor and management. The diagram, Fig. 2, displays the principal divisions of manufacturing betterment.

**17. Material.**—Betterment in material from the manufacturing viewpoint is mainly a matter of proper selection by the purchasing agent. To this end the tendency should be toward more and more exact specification of what is to be purchased. This applies not only to material to be used in the product, but also to the purchase of supplies of all kinds, from coal to lubricating oil. In nearly all these things standards exist. That is to say, it is frequently possible to indicate precise qualities, any departure from which means a lessened usefulness or efficiency. The more nearly standardized the material,

the more uniform and satisfactory the results, always supposing that a thoroughly qualified person has issued the specification.

The investigation of new commercial kinds of material should also be freely undertaken. Claims of superiority or novel advantages, made for a material on the market, should be investigated wherever possible, because it is only by having and keeping an open mind that improvements can be adopted. Off-hand and snap judgments should be discarded in favor of experiment and demonstration. Again, the question of reducing waste is a matter that demands close attention. Precise accounting in the stores will diminish habitual carelessness in this respect. Wherever there is an opportunity for material to be wasted, spoiled, thrown away, or hidden, precautions should be taken to minimize losses. Even though the precaution costs as much as has been saved, the indirect moral effect will be worth a good deal.

**18. Improving Process Efficiency.**—Very few executives can truthfully assert that their processes are on a basis of extreme efficiency. The fact is, it is impossible to form any useful judgment in the matter except on the basis of actual experiment and trained observation. Improvement in efficiency of process work depends on systematic examination of the facts. It is desirable, therefore, in those industries in which each step in operation is not planned in advance, as in machine shops, to give periodical attention to the way in which process work is being conducted. Time studies should be made of each step of the process, and with these in hand careful consideration should be given to methods of reducing operating time. Where the situation seems to demand it, motion studies can also be made, thus giving a further and closer analysis of the real nature of the process details. In such simple matters as lifting and handling bags of material at vats, taking up and putting down parts to be worked on, and similar small details that ordinary observation entirely misses, time and motion studies often point the way to increased speed or increased economy.

**19. Taking Processes for Granted.**—One of the great obstacles to progress is the ingrained human habit of taking existing practices for granted, and assuming that they are correct and incapable of improvement. It will generally be found that in an industry that has never been subjected to the scrutiny of the new methods of analysis, process work is by no means reduced to its utmost simplicity. The wise course, then, is to regard each and every process as improvable. This does not mean that a corps of experts should be let loose in the shops on a general "let-me-show-you" basis, but that quiet, systematic study and analysis should always be going on. The sympathy of the foreman and workers should be enlisted by practical demonstration that the work is not intended to diminish their privileges and rights. Where group bonus is in use the bearing of process betterment on increased remuneration will be close and therefore likely to enlist the cooperation of workers rather than incur their hostility. With a favorable atmosphere established in the shop it should be possible to obtain patient trial for new methods. Moreover, if the idea of *continuous* betterment can be implanted in the minds of the foremen and workers, it is probable that very satisfactory results will be ultimately attained, nor will the profits be swallowed up by the cost of development.

**20. Speeding Up Operations.**—In the matter of operative machines, perhaps in most industries the opportunities for betterment are not as ready as in the matter of processes. Moreover, the question is here very largely a technical one. Something more than accurate observation and common sense is necessary to effect improvement, since both technical knowledge of the material and engineering knowledge of machines are required. At the same time, the principle of taking nothing for granted applies just as strongly here as to process work. The directions in which operative machines may be improved, apart from technical considerations of design, are not many. Increasing the speed of working is the most obvious, but in practice this cannot be done in many industries. The impulse toward speeding up came from the machine shop, but acciden-

tal conditions made it so successful there. Metal-working machines as a class happened to be far below true capacity, in their actual performance; the material on which they operated would have stood very much higher speeds of working than was either understood a decade ago, or, in the absence of the right tools, was even practicable. It must not be supposed that similar triumphs are to be obtained in other industries as a matter of course.

**21. Directions of Improvement.**—In many industries the limit of working is found to reside, not in the machine, but in the material, or in the rate at which changes can be impressed on the material. This remark does not apply to such processes as printing on paper from type, for example. Here there is hardly any technical limit to speed; it will depend almost wholly on mechanical considerations. But in other types of operation the mechanical limit is far above the technical limit. In folding paper, cloth, etc., such technical limit is soon reached; the material will not react to the higher speed. In dyeing, high speed simply gives a different result from low speed. Speeding operative machines, therefore, has its limits, but it is desirable that these limits should be found by actual experiment, and not be taken for granted. In some cases improvement can be obtained by different methods of handling the work in its passage through the machine and by auxiliary appliances. In machine work, the jigs or holders of the work play a very important part. The feeding of machines should be as automatic as possible, and much may be done along this line. Power consumption is another promising field for improvement. It has been very little studied. Frequently power is absorbed by a machine, out of all proportion to the amount required at the moment of operation. The progressive manufacturer will also keep his attention on the development of new types of operative machines.

**22. Obsolete Machines.**—In industries that are undergoing rapid development it may happen that technical invention gives rise to new and superior machines at a rate that is very vexing to persons who have invested money in manu-

facturing equipment. The question then arises, as a matter of policy, what is to be done when a new and obviously more efficient machine is put on the market in competition with the old. If the cost is not high in proportion to the total investment in the plant, the bold course is probably the best in all cases. The old machine should be sold for what it will bring, and the new one substituted. The difference should be borne by profit and loss. It is evident that the sooner this course is adopted after the new machine has proved its superiority, the better, since the value of the older type of machine as a second-hand proposition will then be at a maximum. But where the new machine is expensive, more caution is necessary. Attempts have been made to produce formulas that will indicate at what point it will pay to scrap old and replace by new types. But the real limit is that of financial strength. The change, if it is to be made at all, should be made as soon as possible. Care must be taken, of course, that the new types are not only demonstrably superior, but that they are reasonably likely not to be superseded in their turn before they have paid their way. This question is one of the most difficult to deal with satisfactorily. Such emergencies as are here discussed furnish an argument for establishing a strong reserve fund, from which unexpected calls of this kind can be met without unduly straining the resources of the business.

**23. Handling of Material.**—In the heavy industries, such as the production of coal, steel, cement, and so forth, the handling of material and product has been reduced to a fine point. Mechanical conveying is the universal practice, some of it being of extraordinary complexity and costly to install. In the lighter industries, especially in general manufacturing, a great field exists for realizing important economies in the handling of material at all stages. In too many plants no provision exists for systematic handling of material or product. It is even today frequently left to the operative employes to fetch the material they need from its last station, or to pass it on to the next, with a consequent stoppage of production that cannot be made up in any possible way. The plant superinten-

dent who is horrified at the idea of having expense wages on his shop pay roll, will cheerfully allow machines to be idle while their operatives are running about handling material and hunting for work to do, because under the faulty cost systems usually employed, such lost time does not show up, but all falls into direct cost. The executive searching for possible fields of betterment can hardly find a more promising one than this, in the majority of instances, unless his industry happens to be of the heavy or the continuous class, wherein mechanical conveying is already an established practice.

**24. Survey of Handling.**—The first step to be taken is to establish a basis of fact. In other words, a thorough study of the routing of all material and product must be undertaken, and conclusions must be reduced to plan and chart form. At every stage or stopping place close analysis must be made of what happens. On every line of flow the quantity as well as the direction should be charted. Having ascertained the basic facts about the movement of material and product, the next step is to ascertain the actual cost of handling. This can be done only by careful time study of the various stages. Where operatives are concerned in the handling, the time during which their machines are idle should be made a part of the record, and a valuation of the loss calculated. When this survey has been carried out, it will generally be found that the cost of handling and running to and fro on errands connected with the movement of material is very much greater than any one suspected. The survey should, of course, commence with the arrival of material in the plant, its unloading and passage into stores, its handling there, and in all subsequent stages, until the finished product is delivered into warehouse. A separate survey may sometimes be made of its subsequent movement up to the point of delivery to the railroad or other carrier.

**25. Acting on the Survey.**—When the survey is completed, the next step is to consider what measures should be taken to reduce the expense of handling. In some cases it may be found possible to install belt conveyers or overhead trolley



systems. These, however, are valuable only if two conditions are present. First, there must be continuous and heavy traffic along the line of flow served by the conveyer or trolley; and, second, it must be certain that this line of flow is to be permanent. Usually the installation of mechanical conveyers should be postponed until other and less costly solutions of the problem have been discussed. Where the buildings are sufficiently strong to bear the weight of electric tractors on the floors, this system affords a very quick and extremely flexible method of handling. A brief introduction to the subject was given in a preceding Section; but developments are taking place constantly in this field, and the subject is one that can be no more than indicated here as a promising solution of the handling problem in an ordinary manufacturing plant.

**26. Modifying the Layout.**—Where heavy machinery is already installed, modification of layout cannot be entertained. Where machines and benches are easily transferred to new locations, the results of a material handling survey may disclose that the original layout of the plant is no longer suitable. Routes or flow lines between departments may be too long or circuitous. In multi-story buildings it may be found that there is too much traffic through elevators, and that rearrangement of floors may eliminate some of this. It constantly happens that an originally good layout has become modified by the insertion of new machines rather from the point of view of ease of installation at the moment than from a consideration of their proper place in the routing of the product. After a number of years, in a plant where such changes have taken place, a survey often discloses an extraordinary tangle of routing. The only real remedy for such a condition is a realignment of machines in conformity with a well-planned routing, in which due consideration has been given to the method of handling that will give the most economical results. As has already been remarked, the subject of handling is undergoing rapid development at the present day, and the wise executive will keep himself in touch with new types and methods, and by that means keep his handling methods abreast of the times.

#### THE HUMAN ELEMENT

**27. Better Working Environment.**—The standards of what is to be considered a good working environment have changed very much in recent years. There are still to be found plenty of plants in which very little has been done to create good working conditions. Dirt and untidiness, bad light both by day and by night, inadequate heating in winter, and insufficient ventilation in summer, unfenced and unguarded machinery, absence of decent sanitary accommodations—all these features marked the old type of factory, and are still only too prevalent. The modern progressive executive has found it desirable to abolish these reproaches against industry, not only from pride in the undertaking, but for the very good reason that it pays to do so. While human beings seem to be able to work under more unfavorable conditions than almost any other highly organized living thing, it is not to be supposed that they work at their best under such conditions. On the contrary, it is now generally accepted that the best working conditions and environment are none too good. While it is not necessary to go to the extreme of providing floral decorations and pink teas, it does pay to insure the absence of all adverse conditions that lower the vitality and depress the workers.

**28. Survey of General Conditions.**—As opportunity offers, the executive will do well to bring his plant, if old-fashioned, into line with modern ideas. This can be done with greater success if a definite program is set out, based on a complete survey of the shortcomings to be remedied. Such an examination should take as its first line of attack the question of clear space. No space should be allowed to become a junk heap. Tidiness is a true indication of a state of mind. Every square foot of working space in buildings and shops should have its definite use, to which it is strictly confined. Next, the problem of lighting, both by day and by night, should be attacked. Incredibly bad conditions, easily remedied, may often be found here. Heating and ventilation involve the expenditure of capital, but in most cases it is an expenditure that is essential.

Early morning in cold shops is a time when the appearance of working is not necessarily the same thing as brisk production. It is highly desirable to arrange for shops to be heated before work commences, and not while it is in progress. This is not so much a matter of additional expenditure, as of proper management of existing heating facilities.

**29. Safety First.**—The active propaganda on the subject of safety that has taken place in the last few years has unquestionably been the saving of many lives and has raised the efficiency of work in many plants. Men are very readily found who are willing to work under dangerous conditions, and apparently in utter disregard of them. It seems to be proved, however, that dangers do cause slower and less effective work. Apart from the moral responsibility of the executive, it is very desirable that a safety survey should lay the foundation of a safety campaign in every plant that has not already cultivated the habit. The posters and literature of the National Safety Committee cost but little, and should be exhibited in every plant, whether the industry is hazardous or not, so as to cultivate an atmosphere that will result in freedom from accidents.

**30. Various Opportunities for Favorable Influence.**—In large plants, particularly if located in the country, encouragement of a good living environment may be added to that of good working conditions. One of the most important services that can be rendered to the workers, with good prospect of a fair return, is the provision of lunch rooms or cafeterias, close to the plant, where good food, properly cooked, can be obtained at something near cost price, by the workers at midday. An enterprise of this kind is more likely to help in establishing a proper atmosphere if the workers are given an opportunity to elect representatives on the board of management of the undertaking. Otherwise, it has not infrequently happened that agitators have taken the opportunity to insinuate that the firm was profiting from the business, and were exploiting the workers, when the truth was that the service was carried on at a loss made up by the firm out of profits. Space does not

permit more than reference to the promotion of clubs for recreation purposes, or of athletic fields and similar developments. In country plants the executive will do well to consider the advisability of setting such activities in motion, but always with participation by the workers in the management and organization of them.

**31. Improved Labor Relations.**—The question of labor relations looms very large at the present day, and forms one of the most vexing problems with which the executive has to deal. The difficulty of the situation arises in part from its vagueness. The spirit of unrest that is prevalent is by no means a matter of wages or earnings alone. A strain of discontent seems to exist that it is very difficult to allay, because its cause is nowhere clear and visible. No doubt much of the feeling is due to the loss of direct contact between employer and employe, a loss arising from the large size of modern undertakings. Another circumstance that works in the same direction is the great subdivision of manufacturing operations; each man's attention is confined to some insignificant item, of which he does not perceive, and is never assisted to perceive, the place in the general scheme of production. The plants in which the workers are genuinely interested in the work, and in the welfare of the undertaking as a whole, are not very numerous, but they do unquestionably exist. Where this is the case, it will generally be found that the personality of the executive has a great deal to do with the matter. Some men have a natural power of creating an atmosphere of sympathy and respect around them. Others lack this entirely. Between the two extremes almost any degree of loyalty and of indifference or worse may be found.

**32. Personal Touch.**—The aim of every executive must be to create a favorable atmosphere in which the employes will work with understanding of what their part is in the whole, and with a self-conscious pride in the success of the firm. It is easy enough thus to state the aim; it is quite another matter to give advice or rules for attaining this aim. The truth is that no general rules can be laid down; everything

depends on the personality of the executive and his reaction to existing conditions. No two executives will approach the problem from the same angle; no two will proceed in the same way to create confidence. Methods that are successful in the hands of one man may be quite unsuccessful in the hands of another. Perhaps the most important thing is to convince the executive himself that the atmosphere existing in his plant is to a large extent within his control, but that he can make this atmosphere a favorable one only by examining closely into his own reactions with his employees, and considering carefully what action seems to him likely to lead to a sympathetic connection.

**33. Partial Solutions of the Labor Problem.**—Too much stress is sometimes laid on questions of remuneration. It is true that high pay will compensate for much. Very bad conditions will be tolerated where earnings are larger than can be made elsewhere in the locality. But such a condition is not lasting. It is only submission that is secured by this means. Grievances are bottled up, but the time comes when the pressure is too great and there is an explosive outburst. On the other hand, too much stress is often laid on what is called welfare work. This is not a substitute for good conditions, but it is a powerful auxiliary to contentment where conditions are otherwise good. Something more than either of these palliatives is required to create and maintain what has here been termed a favorable atmosphere, that is, one in which the workers feel at home, consider themselves identified with the firm, and are genuinely interested in its success. It is probable, however, that much may be done by attention to certain fundamental ideas, which are after all only those naturally suggested by a common-sense view of the conditions of modern industry. This will become apparent in the articles which follow.

**34. Failure of Modern Industry.**—It may be taken for granted that whoever possesses an interest in life will be reasonably happy and contented, even though fate may deal some hard knocks in the course of events. It cannot be overlooked that modern industry, somehow or other, notoriously

fails at just this point. It fails to interest the workers. Even the laborer who tills the field has the satisfaction of knowing just what part his hard labor has in bringing about the harvest. The farmer's work is probably much harder than any work found in industry, except the lowest kind of laboring, but he is rarely found to be filled with sullen resentment against his lot. He grumbles, of course, but that is a different matter. He does not revolt, nor turn ferociously against the work that provides his living. From this observation some idea may be derived of the importance of letting the worker perceive his place in the general scheme of operations. Solitary confinement in the dark is said to be the most terrible punishment that can be meted out to a human creature. Yet many workers are, in one sense, shut up with uninteresting jobs, cut off from all understanding of their purport, and unable to exchange a single idea about them with any other human being.

**35. Making Work Interesting.**—It is not always possible to make work supremely interesting, but it should be made as interesting as possible. Almost any work has importance. It is part of an intricate pattern, and unless properly performed the pattern will not join. Here, then, is a first line of attack. Let the significance of every job be explained to the worker. Show him how, and in what way, successful performance of the job is going to help the next man. Explain to him what happens if the job is not properly performed. Let him understand the train of bad effects that is set in motion by a failure to do good work. This must be done tactfully, not with the flavor of a threat, but with that of an explanation addressed to an intelligent man. It is understanding that must be cultivated, pride in the job that must be evoked. All this will take time, tact, and effort, but it is fundamental. It is real constructive work. If adequately carried out its effect will be permanent, in the sense that a new atmosphere will be set up. There are, also, other ways in which interest can be cultivated in the workers as a body, but they should supplement and not supersede the attempt to interest the individual worker.

**36. Group Interest.**—Another way to encourage the interest of the workers and create an atmosphere of *esprit de corps* and cooperation, is by leading them to regard the firm as an institution of which they are members. The use of lectures for this purpose has already been mentioned. But this is only part of a general propaganda that may be undertaken. The aim should be to foster the feeling that is easily aroused when any body of men are assembled for a common purpose, namely, group pride. If a tithe of the effort expended to trumpet the fame and glory of the firm among possible customers were devoted to increasing its prestige among the workers, much good would be done. The trouble is that, too often, the workers do not realize that they are assembled for a common purpose. Too often they regard the firm as something apart from themselves, something with a life of its own which is not their life. It is precisely this attitude that is to be converted into the other just mentioned. If they do not feel that it reflects credit on themselves to belong to the firm, they are not very likely to take up other than a grudging and covertly hostile attitude toward it, whatever benefits it showers on them by way of welfare work or other gratuities.

**37. Instruction.**—To give the worker interest in his work, and to make him feel that he is part of a body of men assembled voluntarily for a common purpose, are the two fundamentals to be realized in creating a favorable atmosphere. Practical methods of doing this are not wanting, even today, although doubtless the immediate future will see considerable developments in this direction. To begin with, the question of proper training for all new employes should be carefully considered. Here is the opportunity to do what has already been suggested, namely, to imbue the worker with an understanding of the relation of his particular work to the whole. The first step is to give precise instruction as to the right way to do the job. Show the worker that it is, in the point of view of the firm, an important job. Explain why it should be done right and what will happen when it is not. Assemble all the particulars that can be put together about the job, even if it

is only a sweeper's job. Even in elementary work such as this, some idea as to the dangers of germs, of the scientific value of cleanliness, of the importance of not raising dust, can be found and imparted to the worker. But commonly he is given a broom and told to sweep. This is meant only as an illustration, but if interesting points can be brought out about such a simple thing as sweeping, it follows that equally interesting matters can be imparted about more difficult productive processes that play their part in the great drama of business.

**38. Conclusion.**—If the arousing of the worker's interest in his job is linked up with some form of group bonus, such as has been described in a former Section, two things will have been done. Not only will interest have been aroused, but this interest will have been directly connected with the work of others. The worker will not only have been told that his work bears on that of others and influences its success, but the group bonus will translate the statement into actual money value. What one man has been told by the firm will be corroborated by his shop mates. Each man will find interest outside his own narrow round of duties to an extent that can hardly be realized in any other way. Beyond this, something may be done by admitting the worker, cautiously and conservatively, into an association with those who control the conditions immediately around him. Let the worker have some say and exercise some responsibility as to the maintenance of the conditions that exist around him and under which he works. This must not be done too rapidly or without careful consideration, but it is one of the practical means at hand for the executive to promote a better atmosphere among the workers.

#### MANAGEMENT BETTERMENT

**39. Introductory.**—Management betterment includes several relations of very different character. There are three main directions in which the executive can exert influence, from the viewpoint of management. There is, first, his relation with the outside, through his selling arm; second, the



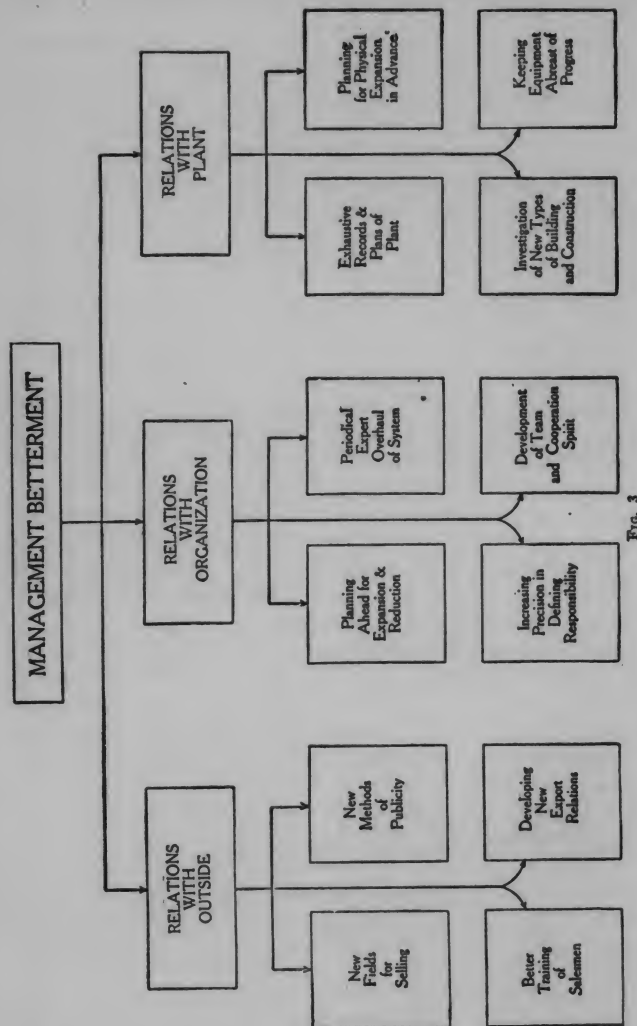


FIG. 3

improvement of the internal organization, as an organization; and third, the improvement of the plant, regarded as a physical organization. When these three divisions of executive relations have been covered, the task of reviewing the opportunities and methods of betterment will have been completed. Fig. 3 shows, in diagrammatic form, the sphere occupied by the possibilities of betterment in management.

**40. Relations with Outside.**—The hope of improvement in outside relations, that is, in the amount of business done, is never-ending. The executive will be always on the watch for opportunities to increase his business, by adopting new varieties of sales propaganda, and by perfecting his sales and field organization. Four clearly marked routes to this end can be distinguished. First, there is the search for new fields for selling operations, either in the direction of unoccupied territory, or of territory that has as yet not been fully developed, or in the direction of finding new uses for the product. This last is generally not so much a concern for the sales force as for the technical advisers. Second, selling operations may be intensified and encouraged by giving systematic attention to the training of salesmen, and schooling them in the arguments and slogans that have been found most successful under given circumstances. Third, new methods of acting on the customer or possible customer, that is, new publicity methods, may be developed. Finally, attention may be directed to the export trade, a matter so entirely different from the home marketing of product that it demands a specialized organization.

**41.** Certain aspects of the matters touched upon in the preceding article have been treated at some length in a foregoing Section, and it is therefore unnecessary to go once more over the ground in detail. It is desirable, however, at this point, to urge attention to the necessity of conducting efforts toward betterment in sales management on a well-designed plan. The whole selling field should be mapped out as far in advance as possible, and though particular conditions may make it advisable to switch off suddenly from a gradual devel-

opment to a forced development in one direction, yet the importance of a comprehensive survey of the possibilities in all fields should never be lost from sight. The point under consideration here is not routine operation but extension. Such extension will be all the more sound if calmly and deliberately undertaken. Whereas the organization itself has been planned for an immediate, visible need, the field of new activity should be surveyed in advance. Only in this way will progress be made in an orderly manner when the time comes for action. If it is foreseen that at a certain date increased dimensions must be given to the selling force, it is desirable to have the force ready when the moment arrives. But if development is not determined in advance, it is likely to be haphazard when undertaken, with consequent imperiling of its ultimate success.

**42. Internal Organization.**—Whether it is regarded merely as a set of individuals, or, collectively, as a system, the internal organization of a business is not a static thing, a completed edifice. The greatest flexibility is essential at all times, since the organization should react to every condition of business, and should be capable of indefinite expansion, or, if need be, of a certain amount of contraction, without serious loss of efficiency. There are four ways in which the executive should exercise influence for betterment on his organization. First, by promoting the flexibility of the establishment; second, by insuring a continual development of precision in responsibility, so as to make the organization more and more precise as a tool; third, by developing in the staff a team spirit and sense of solidarity with the firm, similar to that discussed in a preceding article in reference to the operative workers; and fourth, by keeping well in mind the necessity for periodical stock taking and revision of the system.

**43. Planning for Reduction.**—A situation that is apt to occur in any plant is the necessity for some degree of reduction of the organization in slack times. Although everyone expects this, such emergency is rarely prepared for in advance, with the result that when the time comes the salary pay roll is vigorously cut, with but little attention to the preservation

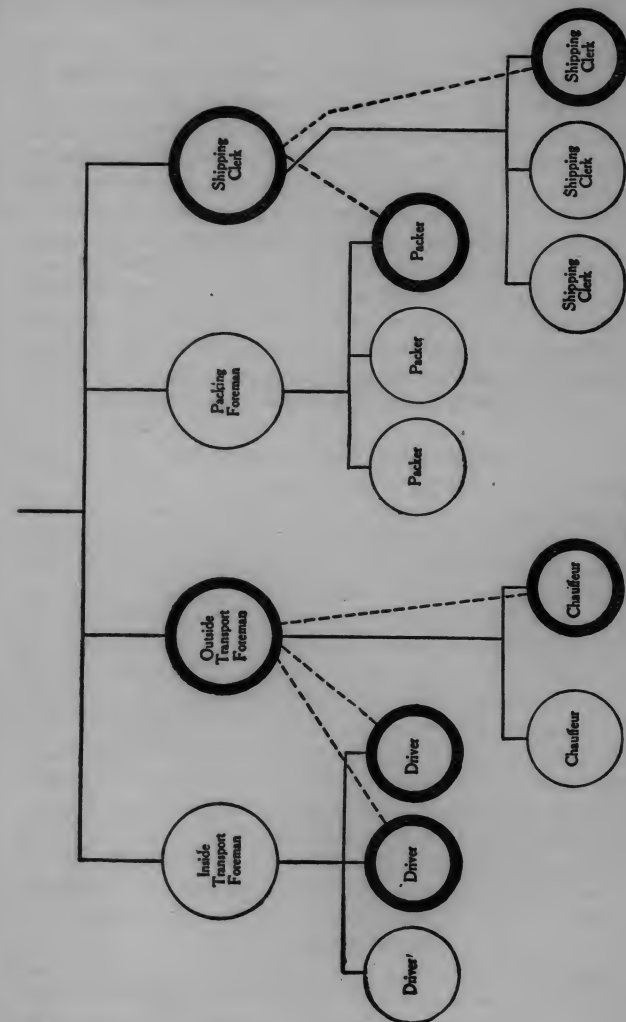


FIG. 4

of the efficiency of the organization. Where proper organization charts have been prepared, opportunity exists for the cool consideration of the form the organization should take in slack times. Bureaus and sections may be temporarily consolidated in such a manner that the men who are kept possess the right kind of experience for double duties, and those who go are of the least permanent value to the organization. Fig. 4 shows a portion of an organization chart that has been subjected to this study. Four bureaus are shown, in which normally eleven men are employed. The circles in heavy black and the dotted lines represent what will be left after a reduction has taken place. Two bureaus employing five men are shown as remaining, but the work has been so apportioned that the reduced force will be capable of handling the business effectively.

**44. Defining Responsibility.**—It is often supposed that specialization of duties is the principal point to be attended to in setting up an organization. Though this is very important, it may be well to consider the matter from another viewpoint. Specialized duties are simply another aspect of definite responsibilities. If a man's attention is confined to one thing, he is responsible for that alone, and it is to be expected that he will be able to perform it more efficiently than if his attention were required in two or three directions. This, in fact, is the theory of specialization. But much of the satisfactory result is due directly to the close defining of his responsibility. It is rather this than a high degree of specialization that makes system effective. Where organizations are found to be working unsatisfactorily, it will usually be found that it is not the degree of specialization that is at fault, but the absence of clearly demarked spheres of responsibility. The executive therefore should continually strive to bring definite spheres of responsibility into clear relief. This is always a matter of time and patience, as every complication cannot be seen in advance even by the most experienced organizer. But if written manuals of duties and organization charts are in use, these can be revised as each new case of confused responsibility occurs, and so in time the situation will be clarified, and few opportunities for confusion will remain.

**45. Developing Right Atmosphere.**—Just as it is important to encourage and foster the right kind of atmosphere in the plant and among the wage earners, so it is equally important to develop group pride among the rank and file of the staff. A disposition to watch the clock is perhaps even more marked in offices than in shops, it being the case that routine office work is at least as uninteresting as the most elementary kind of machining. The executive may usefully give some attention to plans for arousing the interest of the office staff. As in the case of the plant, this can be done only by demonstrating to the clerks just how their work dovetails into and is bound up with the efficiency of the whole organization. The methods referred to in the earlier articles, dealing with the labor problem, are also applicable to the staff. Nothing is ever lost by enabling people's imagination to grasp something of the great game of business, of the relation of the firm to this game, and of their own relation to the total activity of the firm. Publication of data as to the amount of work turned out by divisions, where it can be arranged, has a good effect. The work of individuals may also be contrasted in this way. This plan is, however, probably more effective if confined to occasional periods; if constantly applied it may come to be looked on as a pace-making device, and arouse hostility instead of emulation.

**46. Periodical Overhaul.**—Very few executives understand that an organization is not like a building, designed and constructed for a long term of years. It is much more like an army in action which is constantly being modified by contact with its work. The defect of government organizations is their slow reaction to change, and in proportion as any organization is looked on as perfected, the danger of its running down becomes greater. In business, change is going on continually. Even where an organization is securely charted, time will produce shifts not recorded on the chart. Men come and go, hasty removals are often necessary, some men shrink from responsibility, while others tend to grasp authority. It will happen usually that organizations begin to change as soon

as they are set up. This is not of great consequence, if the process is not allowed to go too far, though it is precisely this kind of change that blurs the lines of responsibility. The executive should therefore make a point of recharting his organization at least every two or three years, or at other suitable intervals, according to circumstances. This is work that is best entrusted to an outside expert for two reasons, one being the peculiar kind of experience necessary, and the other the prevention of that jealousy which is sure to arise if so delicate a task is entrusted to one of the regular staff.

**47. Relations With the Plant.**—In a business that is not standing still, but is undergoing a healthy increase, it will usually be found that the plant, quite as much as the organization, is subject to changes. All kinds of alterations, large or small, will continually be going on, and in many cases this condition is almost ignored by the executive. Very rarely is any forethought given to the question of expansion as a whole. Every move is made on the spur of the moment, when the need is felt, and usually not until it has become insistent. Then things are hustled along and everyone is satisfied that an exhibition of good management has occurred. But if we were to look closer into such a condition of affairs, less approval would be forthcoming. When things are done by main force, it will usually be found that great waste has occurred. Tearing down is in too great a proportion to building up. Hasty decisions are made, equipment is located according to temporary convenience, and presently it is found that something has been done that seriously interferes with the carrying out of some other even more necessary measures. Gangways are narrowed, light is obstructed, machines are erected out of alignment with routing, and all kinds of wasteful confusion occurs where no forethought is given to the obvious fact that the business is expanding.

**48. Plans and Drawings.**—Few plant managers think it necessary to provide adequate plans of their buildings and layout. In particular, plans of piping and similar complex service equipment are very rarely found in use. The result

is enormous waste of time in making alterations and extensions, and serious accidents are not unknown from this cause. In all plants of any considerable size, complete plans of all piping, wiring, sprinkler systems, fire mains, and hydrants should be made, and care taken that no changes are made anywhere without immediately informing the department having charge of the plans, so that the necessary alterations can be made. Obviously, if such plans are not kept up to date, they are of very little use. Concurrently with the plans, a system of different colors for pipes and wiring conduits should be adopted, distinguishing between high- and low-pressure steam; high- and low-tension electric current; telephone and signal wires; water and hydraulic conduits; air pressure; sprinkler and fire lines; all these should have their distinctive colors, so that they may be distinguished at once. Large-scale plans of the buildings and yards should also be made, and alterations of every kind regularly marked on them. Information of importance about plant, buildings, or equipment should not be allowed to remain in someone's head, but should be reduced either to drawing or to writing. The value of this will not always be seen at first, but when information of this kind is wanted it is generally very badly wanted, and its absence leads to much greater loss than the small cost of making and keeping such plans up to date in the first instance.

**49. New Constructions.**—Much progress is being made at the present time in types of factory construction. This remark applies not only to the general types of actual building construction, such as steel construction, concrete, mill type, etc., but, to an even greater extent, to constructional details. New types of window lights, roofs, flooring, ventilating and heating systems, and so forth are being developed. The new ideas regarding proper working environment are being responded to by the engineers and architects, so that in a few years' time the prevalent type of factory will be very different from that in vogue even ten years ago. The prudent executive who finds himself in charge of a growing business or of one that is likely to grow in the near future, will keep himself in touch



with what is going on in this field. The subject is intimately bound up also with the question of internal transportation. In fact, buildings should not be thought of apart from the methods to be used for handling and transporting goods and materials in and about them. The electric tractor system that uses ramps instead of elevators, and elevator systems that can handle whole trains of local transport devices, are important factors in building selection. Space does not allow the matter to be discussed here, but it is certainly one that the executive should keep in mind where extensions are in progress.

**50. Conclusion.**—The future must always be kept in sight. This is a point that cannot be overemphasized. Operations tomorrow may be hampered and retarded by want of foresight today, and this foresight is peculiarly the province of the executive. If he has properly devoluted his detail responsibilities on competent assistants, as indicated for different departments in the foregoing Sections, he should have leisure to keep closely in touch with the problem of development and extension. It must be remembered that competition never ceases. More than this, new competition is necessarily more formidable than that to which the executive is accustomed. New competitors usually have the advantage of the most up to date equipment and the most advanced ideas. They have, frequently, the advantage of knowing all about the plans and methods of the existing firms, while the latter know, of necessity, very little about those of the attacking adversary. The only way to meet opposition of this kind effectively, is not to be taken by surprise. Exhaustive and accurate knowledge about one's own business is the first line of defence, because only on that can judgment for new action be based. The executive who is satisfied with half information or with mere expression of opinion from some subordinate as to the efficiency of any of his operations yields up half his armor. At the present time no more important slogan can be recommended to the executive than the simple one: Be prepared.

### EXERCISES

- (1) Illustrate by examples the meaning of the terms *by-product* and *waste product*, and the distinction between them.
- (2) What policy should be followed regarding obsolete machines: (a) in a firm with large resources? (b) in a firm with limited resources?
- (3) Illustrate by the aid of Fig. 4 how flexibility can and should be provided in laying out staff, and how such flexibility will meet emergencies arising either from forced reduction or forced expansion according to the condition of business.
- (4) Why is a well-organized information service essential to effective technical research?
- (5) Explain why it is necessary to make periodical surveys and revision of a business organization.
- (6) (a) Point out how the course of training for new employes may be used as an opportunity to give the worker the right mental attitude toward his work. (b) Why is this important in relation to labor troubles?
- (7) Show how lack of prearranged plans to meet demands for enlarged equipment is apt to cause confusion and conflicts in the layout of the plant, which could have been avoided by judicious planning ahead for such emergencies.
- (8) Among the conditions that the executive must be prepared to meet is the appearance of a new competitor. In certain respects such a new competitor always has the advantage of the situation. Explain this last statement.
- (9) What attitude should be taken toward the possibility of increasing output by speeding up operating machines?
- (10) State some of the directions in which technical research may with advantage be applied.

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